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Epidemiology of Motor Vehicle Injuries in Suffolk County, New York Before and After Enactment of the New York State Seat Belt Use Law

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16. Abstract

A population-based study of hospital and medical examiner reported vehicular trauma was conducted to determine the efficacy of the New York Law which compared pre-law 1984 occurrence and severity patterns with those of post-law 1985. Vehicles and occupants covered by the Law were identified primarily by matching the hospital cases with official crash reports; 95 percent of the covered cases (N=2152) were matched. From a census of medical examiner's cases covered by the Law (N=192), all were matched.

During October 1984, pre-law observed seat belt usage in Suffolk County was 16 percent. A nearly fourfold increase in usage was observed in January 1985, when the Law was first enforced; in April of that year observed usage declined to 54 percent; by September usage dropped to 44 percent. The initial sharp increase in usage patterns during the first quarter of 1985 was coupled with an estimated 20 percent decrease in vehicular injury occurrence rates for drivers of vehicles covered by the Law. The proportion of drivers with head and brain injuries decreased by 32 percent and all facial injuries, including those of the forehead, decreased 28 percent. In contrast, cervical strain and facial fractures increased during that period.

Over the entire 1985 post-law study period, similar changes in injury patterns were evident. Covered drivers across all ages experienced reductions of 18 percent in head and brain injury, 17 percent in facial injuries and 20 percent in forehead injuries; however, they also incurred a 35 percent increase in cervical strain.

These findings demonstrate a clear shift in the pattern of injuries and a concomitant decline in their severity. The findings are consistent with the hypothesis that promulgation and enforcement of belt use laws are contributing to a reduction in the overall occurrence of vehicular injuries and the severity of head injuries.

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EPIDEMIOLOGY OF MOTOR VEHICLE INJURIES IN SUFFOLK COUNTY, NEW YORK BEFORE AND AFTER ENACTMENT OF THE NEW YORK STATE SEAT BELT USE LAW

Executive Summary

A population-based study of hospital and medical examiner reported vehicular trauma was conducted to determine the efficacy of the New York Law. The study compared pre-law 1984 occurrence and severity patterns with those of post-law 1985. Hospital case ascertainment was based on a time-stratified probability sampling plan (N=3223). Vehicles and occupants covered by the Law were identified primarily by matching the hospital cases with official crash reports; 95 percent of the covered cases (N=2152) were matched. From a census of medical examiner's cases covered by the Law (N=192), all were matched.

During October 1984, pre-law observed seat belt usage in Suffolk County was 16 percent. A nearly fourfold increase in usage was observed in January 1985, when the Law was first enforced; in April of that year observed usage declined to 54 percent; by September usage dropped to 44 percent.

The initial sharp increase in usage patterns during the first quarter of 1985 was coupled with an estimated 20 percent decrease in vehicular injury occurrence rates for drivers of vehicles covered by the Law. Changes in injury severity patterns for covered drivers were also observed in that quarter, as measured by the distribution of anatomic injury by body region and severity level. The proportion of drivers with head and brain injuries decreased by 32 percent and all facial injuries, including those of the forehead, decreased 28 percent. In contrast, cervical strain and facial fractures increased during that period. When viewed in terms of relative risk to drivers, head injury declined by a factor of two and mild cervical spine injury doubled.

Over the entire 1985 post-law study period, similar changes in injury patterns were evident. Covered drivers across all ages experienced reductions of 18 percent in head and brain injury, 17 percent in facial injuries and 20 percent in forehead injuries; however, they also incurred a 35 percent increase in cervical strain. For covered drivers under 20 years of age and over 49 years, the proportion of cases with serious injuries (maximum AIS 3 or greater) declined by more than 75 percent. Children, ages 4-9 years in rear seats of covered vehicles, experienced a significant drop in concussive injuries.

Important exposure indices increased during the post-law study period, including traffic counts (2.5% to 5% by township), motor vehicle registrations (5%), operator licenses (2%), and reported number of vehicular crashes (6%). These increases in exposure variables tend to work against the hypothesis that the Law is efficacious. Had the Law not been in effect, New York State may very well have experienced increases in occurrence and severity instead of the observed decreases. Thus, the reductions observed in this population-based study should be viewed as conservative, perhaps minimum indicators of the efficacy of this application of the legal deterrent model.

These findings demonstrate a clear shift in the pattern of injuries and a concomitant decline in their severity. The findings are consistent with the hypothesis that promulgation and enforcement of belt use laws are contributing to a reduction in the overall occurrence of vehicular injuries and the severity of head injuries. To the extent that the peak reduction in occurrence could be projected nationally, an estimated 600,000 hospital emergency room visits could be avoided annually if first quarter belt usage levels (62%) could be maintained. These findings are also generally consistent with those reported by Rutherford, Hayes, and their colleagues, who used a similar methodology for hospital case ascertainment in their United Kingdom study.

TABLE OF CONTENTS

Page

Acknowledgements i

Executive Summary ii

Table of Contents iii

List of Tables v

List of Figures x

List of Appendix Tables x

Overall Purpose 1

Background 2

- Mandated Seat Belt Use as an Intervention Strategy 3
- Measurement of Injury Severity 4
- Suffolk County as a Study Site 6
- U.S. Perspective 8

Significance 8

Rationale 9

Objectives 10

Methods and Procedures 10

- Sample Selection Criteria and Schema 11
- Abstracting and Coding Procedures 12
- Record Linking with NY State Department of Motor Vehicle Reports 14
- Classification by Road Use Category 16
- Injury and Outcome Measurements 17

Results 19

- Overall Vehicular Trauma Patterns 19
- Road Use Patterns 20
  - Occurrence 21
  - Admissions 21
  - Fatalities 22
  - AIS Body Regions 22
    - Number of Diagnosed Injuries 22
    - Number of Body Regions with Diagnosed Injuries 23
  - Severity Levels 24
- Drivers and Front Passengers in Vehicles Covered by the Law 24
  - Occurrence 24

TABLE OF CONTENTS (Cont'd)

Page

Drivers and Front Passengers in Vehicles Covered by the Law (cont'd)
Admissions 25
Fatalities 25
AIS Body Regions 25
Annual Patterns 25
Quarterly Patterns 27
Multivariate Analysis: First Quarter 28
Severity 30
Rear Passengers in Vehicles Covered by the Law..... 31

Discussion 32

Conclusions..... 40

Recommendations..... 41

References

Tables (1 through 41)

Figures (1, 2)

Appendix A: Detailed Description of Overall Vehicular Trauma

Appendix B: Scientific Publications, Reports, and Presentations

LIST OF TABLES

TABLE 1 Type, Number, and Percent of Cases in Motor Vehicle Trauma Primary Sample for Persons Treated in Hospital Emergency Departments Serving Suffolk County, 1984 and 1985 Combined

TABLE 2 Number of Cases in Primary Motor Vehicle Trauma Sample by Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 3 Estimated Motor Vehicle Trauma Cases and Occurrence Rates per 1,000 Population by Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 4 Estimated Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Sex and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 5 Motor Vehicle Trauma Fatalities per 100,000 Population by Calendar Period, Suffolk County, New York, 1984 and 1985

TABLE 6 Estimated Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Calendar Period and Sex, Suffolk County, New York, 1984 and 1985

TABLE 7 Estimated Annual Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex for Cases Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 8 Percent Annual Motor Vehicle Trauma Cases by ISS Groups for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 9 Number and Percent of Emergency Department Occurrence Cases, Hospital Admission Cases, and Fatalities Matched with New York State Official Department of Motor Vehicle (DMV) Crash Reports by Road Use Category, Suffolk County, New York, 1984 and 1985 Combined

TABLE 10 Estimated Annual Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 11 Estimated Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Road Use Category and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

LIST OF TABLES (Cont'd)

TABLE 12 Estimated Number of Injury Cases per 1,000 Motor Vehicles Registered in Suffolk County by Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 13 Estimated Number of Injury Cases per 1,000 Motor Vehicles Registered in Suffolk County by Road Use Category and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 14 Estimated Annual Number of Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Sex and Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 15 Estimated Number of Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Road Use Category and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 16 Annual Number of Motor Vehicle Trauma Fatalities per 100,000 Population by Road Use Category, Suffolk County, New York, 1984 and 1985

TABLE 17 Annual Number of Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Road Use Category, Suffolk County, New York, 1984 and 1985

TABLE 18 Number of Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Road Use Category and Calendar Period, Suffolk County, New York, 1984 and 1985

TABLE 19 Estimated Percentage of Treated and Released Cases with 3 or More AIS Codable Injuries by Sex and Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 20 Percentage of Treated and Released Cases with 2 or More Injured AIS Body Regions by Sex and Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 21 Percent Motor Vehicle Trauma Cases in Selected ISS Groups by Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 22 Percent Motor Vehicle Trauma Cases in Selected ISS Groups by Road Use Category for Persons Discharged from Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

LIST OF TABLES (Cont'd)

TABLE 23 Percent Motor Vehicle Trauma Admissions in Selected ISS Groups by Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 24 Estimated Annual Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Age and Sex for Drivers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 25 Estimated Motor Vehicle Trauma Occurrence Rates per 1,000 Licensed Suffolk Drivers by Age and Sex for Drivers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 26 Estimated Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Age and Sex for Front Passengers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 27 Estimated Number of Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Age and Sex for Drivers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 28 Estimated Number of Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Age and Sex for Front Passengers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 29 Fatality Rate per 100,000 Population by Age for Drivers of Vehicles Covered by the Law, Suffolk County, New York, 1984 and 1985

TABLE 30 Estimated Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Casesby Age for Drivers of Vehicles Covered by the Law, Suffolk County,New York, 1984 and 1985

TABLE 31 Estimated Motor Vehicle Trauma Fatalities per 100,000 Population by Age for Front Passengers of Vehicles Covered by the Law, Suffolk County, New York, 1984 and 1985

TABLE 32 Estimated Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Age for Front Passengers of Vehicles Covered by the Law, Suffolk County, New York, 1984 and 1985

TABLE 33 Estimated Annual Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex for Drivers and Front Seat Passengers in Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 34A Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex for Drivers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Drivers, Age 16-19)

TABLE 34B Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex for Drivers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Drivers, Age 20-49)

TABLE 34C Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex for Drivers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Drivers, Age 50+)

TABLE 35A Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex for Front Seat Passengers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Front Seat Passengers, Age <20)

TABLE 35B Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex for Front Seat Passengers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Front Seat Passengers, Age 20-49)

TABLE 35C Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex for Front Seat Passengers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Front Seat Passengers, Age 50+)

TABLE 36A Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex and Calendar Period for Drivers and Front Seat Passengers in Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (First Quarter)

TABLE 36B Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex and Calendar Period for Drivers and Front Seat Passengers in Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Second Quarter)

TABLE 36C Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex and Calendar Period for Drivers and Front Seat Passengers in Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Third Quarter)

TABLE 36D Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex and Calendar Period for Drivers and Front Seat Passengers in Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Fourth Quarter)

TABLE 37 Estimated Relative Risk of Sustaining 1 or More Injuries to a Specified Body Region After Implementation of The New York State Seat Belt Use Law for Drivers of Covered Vehicles Treated in Hospital Emergency Departments Serving Suffolk County, New York, First Quarter 1984 and 1985

TABLE 38 Estimated Relative Risk of Sustaining 1 or More Injuries to a Specified Body Region After Implementation of The New York State Seat Belt Use Law for Drivers of Covered Vehicles Treated in Hospital Emergency Departments Serving Suffolk County, New York, First Quarter 1984 and 1985

TABLE 39 Percent Cases with Maximum AIS Severity 3^+ and ISS 10^+ by Age and Sex for Drivers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 40 Percent Cases with Maximum AIS Severity 3^+ and ISS 10^+ by Age and Sex for Front Seat Passengers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE 41 Total Number of Persons Involved In Motor Vehicle Crashes in Suffolk County, New York, as Reported on NYS State Form MV144, 1984 and 1985

LIST OF FIGURES

FIGURE 1 New York Seat Belt Use Law, Covered and Uncovered Road Use Categories

FIGURE 2 Observed Seat Belt Usage Estimates, Suffolk County, N.Y.

LIST OF APPENDIX TABLES

TABLE A1 Estimated Annual Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Age and Sex for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE A2 Estimated Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Calendar Period and by Age and Sex for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE A3 Estimated Annual Motor Vehicle Trauma Admissions per 100 Injury Cases by Age, and Sex for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE A4 Estimated Motor Vehicle Trauma Admissions per 100 Injury Cases by Calendar Period, Age, and Sex for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

TABLE A5 Motor Vehicle Trauma Fatalities per 100,000 Population by Age and Sex, Suffolk County, New York, 1984 and 1985

TABLE A6 Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (First and Second Quarters)

TABLE A7 Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region by Sex and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985 (Third and Fourth Quarters)

OVERALL PURPOSE

The overall purpose of this study was to determine the occurrence and severity of motor vehicle collision injuries in a well defined population at risk within New York State for corresponding periods before and after the New York law became effective and was enforced (January 1, 1985) (1). This was accomplished by:

1. Determining the incidence rates and severity ratios of nonfatal and fatal motor vehicle injuries in Suffolk County, NY for calendar years 1984 and 1985.
2. Comparing the incidence rates and severity ratios for the baseline years 1984 with the post-law year 1985.
3. Analyzing vehicular injury hospital admissions in Suffolk and Monroe Counties, NY for calendar years 1984 and 1985.
4. Determining specific rates and ratios for predictor and outcome variables including age, sex, time, place, residence census tract, hospital discharge status, severity of injury, disability status, motor vehicle characteristics, and road-use categories.
5. Comparing selected vehicular injury predictor and outcome variables from independently identified hospital cases matched with corresponding police crash reports.
6. Comparing vehicular injury rates and outcome ratios estimated from hospital identified cases with those from official police crash reports.

BACKGROUND

Use of seat belts is known to appreciably reduce death and injury to motor vehicle occupants (2). Health and safety professionals representing a broad range of organizations in both the public and private sectors have been monitoring the New York State (NYS) seat belt use law (3-5) (Figure 1) and comparing the NYS experience with that of the United Kingdom (6), Canada, Australia, and other countries (2). Studies to measure compliance, using National Highway Traffic Safety Administration (NHTSA) observed seat belt usage methodology, have been completed (7-12). Using official police crash report files, studies have recently been completed to measure changes in injury patterns pre and post belt Law passage, but none of these have been linked with data from hospital medical records. There was need to conduct population representative epidemiologic studies based on medical documentation of injury characteristics and outcomes in order to test the hypothesis that the New York State Law resulted in a measurable reduction in nonfatal or fatal vehicular injury risk. This was particularly important in view of continuing concerns about rescinding occupant restraint laws in some states, and the need to establish baseline information prior to the widespread implementation of passive occupant restraint with air bags and automatic belts. In particular, there is need to be in a position to measure changes in the effectiveness of occupant restraint systems to reduce human damage prior to the widespread use of airbags and automatic belts.

Injuries are the leading cause of death each year in the United States for persons between ages 1 and 43 years and the fourth leading cause of death for all ages (13); 32 percent of the United States population is

injured annually. Young adults are at particularly high risk of involvement in transportation related events as they begin driving motor vehicles (14,15). Injuries are the leading cause of lost person-years of productivity in the United States between ages 18-64 years (16). Injury productivity losses are also about two times higher than those from either heart disease or cancer, the next leading causes (17). The personal, family, and societal damage caused by injury events is enormous, with losses estimated at over 70 billion dollars annually (15). Motor vehicle trauma is the major contributor to these losses.

Mandated Seat Belt Use as an Injury Intervention Strategy

To date, 37 countries have seat belt use laws (18), with their collective experience varying from high to low compliance within and among jurisdictions (19). In countries with mandatory seat belt use coupled with strong enforcement programs, usage rates have generally increased sharply and death and injury rates have decreased, but usually not proportionately (19). In Canada, for example, post-law observed seat belt use increased sharply during police enforcement drives, suggesting a need for day-to-day enforcement for maximum effectiveness. Long-term usage rates in Canada generally declined after a sharp initial increase immediately after its law was enacted. Compliance in high risk populations, particularly occupants in the 16-24 year age groups, was lower than in other age groups (19).

Health and safety professionals representing a broad range of organizations in both the public and private sectors have been carefully monitoring the New York State Seat Belt Use Law (enacted December 1, 1984 and officially enforced beginning January 1, 1985) and comparing the New

York experience with that of Canada and other countries (7-11,20,21). To determine the efficacy of this injury intervention strategy, it was necessary to measure in the same population motor vehicle seat belt usage and occupant injury patterns both before and after the NYS Law went into effect.

Studies to measure compliance, using the NHTSA observed seat belt usage methodology (22), were conducted in Suffolk County and in the Nassau/Suffolk SMSA during 1983, 1984, and 1985 (7-11). Because of fiscal constraints, no systematic evaluation of the Law's impact on morbidity and mortality has been planned for the entire state, although a number of agencies are reviewing the pre and post law mortality and morbidity experience. These evaluations are based primarily on NYS Department of Motor Vehicle (DMV) computerized data compiled from police and motorist crash reports.

Recently, epidemiologic research has shown distinct differences in injury mortality and morbidity patterns where both have been analyzed concurrently in well-defined populations (23). In particular, the problem of nonfatal injury sequelae, such as permanent disability, and the impact of related financial burdens have led to increased concern about the need to obtain valid and reliable data on all facets of injury morbidity (24,25), as well as on mortality (26), and to evaluate rigorously the efficacy of intervention strategies.

Measurement of Injury Severity

At present, injury severity is most often measured by fatalities, days hospitalized, hospital discharge status, and disability status and/or

workdays lost. These factors can vary among jurisdictions for the same cause-specific injury because of differences in factors such as third party insurance coverage, no fault/negligence laws, trauma care services, and administrative procedures. Differences in anatomic injury severity for some body regions may be difficult to evaluate, as often seen in neck (e.g., "whiplash") back and spinal cord injuries, or relatively simple to assess as in fractures (27-29). However, anatomic damage per se is rarely used as a measure of severity.

One method of measuring anatomic injury severity, the Abbreviated Injury Scale (AIS), has been used on a limited basis for many years to measure the severity of anatomic injury by body region (30-33). The severity levels in the 1985 AIS revision (AIS 85) are: minor (1), moderate (2), serious (3), severe (4), critical (5), maximum injury virtually unsurvivable (6), and unknown (9). The nine body regions are: external, head, face, neck, thorax, abdomen and pelvic contents, spine, upper extremities, and lower extremities. AIS 85 along with the AIS 85 Epidemiologic Modifications (AIS 85-EM), developed by the Injury Prevention and Analysis Group (IPAG) at Brookhaven National Laboratory (see "Methods and Procedures") allows identification and comparison of injury cases with the same or different anatomic damage, as appropriate, for a particular analysis. For example, the relative severity of head injuries and facial lacerations before and after the seat belt use law went into effect can be measured directly with AIS rather than indirectly using such factors as hospital discharge status (e.g. treated and released from an emergency room compared to admission or "inpatient") as a proxy for severity.

Another measure used to determine overall anatomic injury severity was the Injury Severity Score (ISS). It was derived by identifying the three of six ISS body regions (30) with the highest AIS 85 severity scores and then by adding the squares of those three highest severity scores.

Suffolk County as a Study Site

Suffolk County, the eastern part of Long Island, is bordered on three sides by water and on the fourth by Nassau County. The county comprises 911 square miles and has 987 miles of shoreline, as well as 2,820 acres of inland water and four major recreational rivers with 60 miles of waterfront. It is 86 miles long and approximately 12 to 16 miles wide, its widest point being the 20 mile western border shared with Nassau County.

Although Suffolk County is defined as a metropolitan county, it is composed of a large number of unincorporated areas and incorporated villages within ten townships. The five western towns are suburban and urban in character, with a population density ranging from 3,839 inhabitants per square mile in Babylon to 1,527 in Brookhaven, the township located adjacent to the eastern end of the Island. In contrast, large portions of the five eastern towns are primarily rural, and population density ranges from 375 inhabitants per square mile for Southold to 195 per square mile for Shelter Island (34). The beaches and moderate summer temperatures in the eastern towns attract large numbers of summer residents as well as tourists. The diversification in urbanicity and related factors in the county are viewed as desirable features for a motor vehicle trauma study. For example, variations in vehicular injury rates reflecting such differences may be observed.

The road system in Suffolk County reflects its long and narrow geography. There is only one interstate highway, the Long Island Expressway (I495), which extends east for 33 miles from the Nassau border. Several other major east/west roadways serve the county, but only portions of these roadways have limited access and are divided. There are very few multilane controlled access roads running from north to south. The county has a higher proportion of minor arterial, collector, and local roads than other counties in New York State. Of the 6,846 centerline miles of roadway in Suffolk, 76.2 percent of urban roads and 58.1 percent of rural roads are classified as local (35). According to the New York State Department of Transportation, "accident rates per million vehicle miles of travel" generally tend to be higher for these types of roadways than for controlled access, divided roadways (36).

Suffolk County was selected for this study for a number of reasons. It participated in the "Comprehensive Occupant Restraint Program" (7-10). Using NHTSA methodology, an observed seat belt utilization survey showing 7-8 percent front occupant seat belt use was completed in Suffolk County in 1983, prior to any publicity about this legislation, which could produce bias in measuring before/after differences (11). Suffolk and Nassau County acute care hospitals with emergency departments, County health officials, and the State University of New York Medical School at Stony Brook also have a history of participating in hospital emergency department based studies (37). Brookhaven National Laboratory is the lead organizational unit for injury epidemiology, prevention, and analysis in the Department of Energy system.

U.S. Perspective

This study serves as a starting point for evaluating mandated seat belt use as an efficacious intervention strategy in a well defined U.S. population. It differs from others because it is based on independent identification of motor vehicle trauma from medical records to obtain patient diagnoses, patient outcomes, and related epidemiologic factors. The study protocol contains sufficient documentation for longitudinal follow-up analyses in prospective epidemiologic protocols or in nested case-control protocols for such purposes as measuring costs and long term adverse outcomes. It allows comparisons of injury occurrence, severity, and related factors obtained from hospital records with those compiled from official police crash and motorist reports. The information produced is intended to be immediately useful to public health policy makers and program administrators and to other agencies and organizations concerned with health and safety.

SIGNIFICANCE

The study has been designed to provide comprehensive information on motor vehicle injury incidence, severity, and outcome by using the well-established and cost-effective retrospective epidemiologic techniques developed and demonstrated in the Northeastern Ohio Trauma Study (38). This information is intended to provide decision makers in public health and safety, health services administration, emergency medicine, and the insurance and vehicle manufacturing industries with a comprehensive assessment of the impact of this important application of the legal deterrent model. This study is one of the few, if not the only source of

population representative data on both nonfatal and fatal motor vehicle injuries and their sequelae, pre/post New York State law or any other state seat belt use law. The purpose, objectives, and aims are also consistent with major U.S. national health objectives for 1990, as promulgated by the U.S. Department of Health and Human Services (39).

RATIONALE

Past efforts to measure reduction in human damage in well-defined populations, concomitant with promulgation of seat belt use laws, have been almost exclusively limited to mortality studies. Using techniques derived from the Northeastern Ohio Trauma Study (NEOTS) (23,38), both morbidity and mortality from vehicular crashes have been determined and important indicators of the Law's impact on reducing human damage, not previously available, have been obtained (e.g., case-admission and case-fatality ratios, and anatomic injury severity scoring).

This study was designed to sample motor vehicle trauma cases treated in hospital emergency departments primarily for two reasons. First, police crash reports of injuries and their severity are based on subjective impressions at the collision scene, using the NYS Department of Motor Vehicles classification procedure (i.e., a more detailed classification scheme that can be converted to KABC), rather than on documented diagnoses from medical records. Second, past studies have indicated significant underreporting of injuries from motor vehicle collisions in official crash reports (40).

OBJECTIVES

The objectives of this study were to:

1. Determine the occurrence and incidence rates and the severity ratios of nonfatal and fatal motor vehicle injuries in Suffolk County, NY for calendar years 1984 and 1985.
2. Compare the occurrence and incidence rates and the severity ratios for the baseline year 1984 with the post-law year 1985.
3. Analyze vehicular injury hospital admissions in Suffolk County for calendar years 1984 and 1985.
4. Determine specific rates and ratios for predictor and outcome variables including age, sex, time, place, residence census tract, hospital discharge status, severity of injury, disability status, motor vehicle characteristics, and road-use categories.
5. Compare selected vehicular injury predictor and outcome variables from independently identified hospital cases matched with corresponding official police crash or motorist reports.
6. Compare vehicular injury rates and outcome ratios estimated from hospital identified cases with those estimated from official police crash reports.

METHODS AND PROCEDURES

A modified epidemiologic study design based on the Northeastern Ohio Trauma Study (NEOTS) methodology was used for this study (23,38). A stratified probability sample of motor vehicle injury cases treated during the study periods was identified from the emergency department (ED) records of hospitals located in Suffolk County. Injury cases occurring in Suffolk

County but receiving initial treatment in neighboring Nassau County hospitals were first identified by reviewing Emergency Medical Services (EMS) run sheets of rescue squads located in Suffolk County communities that routinely transport these cases to Nassau hospitals.

Sample Selection Criteria and Schema

ED records in the 14 acute care hospitals in Suffolk County were sampled for possible inclusion in the study. The sampling scheme required examination of every case entered in the ED log of each hospital on 28 randomly selected days for each year. Seven days were randomly drawn from each of four 13 week quarters for each year, 1984 and 1985. Within each quarter, each day of the week was selected once (e.g., 1 of 13 Sundays). For each hospital and each study year, a different set of 28 random days was selected. This provided assurance of equal representation of cases by time of day, day of week, and by each quarter of the two year period. The sampling procedure was divided into two parts, a primary and secondary sample. The secondary sample was taken to ensure representation of motor vehicle trauma cases not identified in the primary sample in order to obtain an adjustment for estimating incidence rates.

For the primary sample all cases on the selected days meeting the primary sampling criteria were identified from the ED log, abstracted, coded, and summarized; this yielded a 7.7 percent sample of all cases in 1984 and 1985. For this primary sample, any case which was stated as motor vehicle accident (MVA), automobile accident (AA), or equivalent, and any case stated as "No Fault" or equivalent was selected. In addition, since some hospitals identified virtually all MVA's in their logs and others did

not, the following additional criteria were established for identification of a possible MVA: any case listed as head, face, neck, chest, or multiple trauma; any group of cases coming into the ED at approximately the same time; and any trauma admission regardless of cause. These criteria resulted in the identification of 3,408 motor vehicle trauma cases (ICD-9-CM: E810-825) for 1984 and 1985 combined.

The secondary sample consisted of a stratified sample of all injury cases occurring on the selected days which did not meet the primary selection criteria. For each case identified, the ED record was pulled and inspected to determine if the case was eligible for inclusion as a motor vehicle trauma case. This resulted in the identification of 54 cases confirmed as first treatment motor vehicle trauma cases for 1984 and 1985 combined.

Abstracting and Coding Procedures

From each retrieved hospital record identified as a motor vehicle trauma case, information was recorded on personal and demographic characteristics (i.e., age, sex, race, address), time and place of injury, time and date of admission to the emergency department, cause and nature of injury using ICD-9-CM (41), injury severity using AIS 85 (30) and AIS 85-EM (42), and discharge status (e.g., treated and released, admitted, died).

Cause of injury was coded using ICD-9-CM E code categories E800-999, with provision for recording up to three codes; motor vehicle injuries were defined as E810-825. Nature of injury was coded using ICD-9-CM N codes to five digits, with provision for multiple diagnoses.

Anatomical injury severity was coded using AIS 85. Since AIS 85 does not provide for coding superficial injuries, contact, or pain to a specific body region, IPAG developed a modified coding classification scheme, AIS 85-EM, consistent with the AIS 85 coding procedures (30). This enables "minor" injuries (e.g., contusion, laceration) which were classified in AIS 85 to the non-specific "External" region, to be assigned to a specific AIS body region. The modification also enables identification of "rule out" or possible injury to a body region and for coding a statement of contact or pain to a body region when there was no other indication of injury to that region. AIS 85-EM is completely adaptable to the existing AIS 85 since it does not alter the standard coding structure. AIS 85-EM based analyses for diagnosed anatomic injuries (which exclude pain, contact and rule-out) were used for this report (42).

Treatment in the emergency room or admission to a hospital for a motor vehicle related injury made a patient potentially eligible for inclusion in the study. Records indicating previous hospital treatment for the same injury event (99 cases) or "normal examination" (86 cases) were abstracted but were excluded from this analysis. Persons with more than one motor vehicle injury event during the study period may have been included more than once in the sample.

Motor vehicle related trauma death enumerations for Suffolk County were obtained from the County Medical Examiner's office. Age and sex specific population estimates were obtained from the Bureau of Biostatistics, State of New York Department of Health.

Quality control procedures included visual scanning of completed abstracting forms, selected independent double coding, computer editing,

and selected independent reabstracting. These procedures were administered as the study proceeded and all findings presented in earlier reports were subject to revision until all data had been collected, verified and analyzed.

Record Linking with NY State Department of Motor Vehicle Reports

The NYS Department of Motor Vehicles (DMV) computerizes police and motorist crash reports submitted to them. Records of every occupant of a vehicle involved in a collision or other motor vehicle occurrence, as well as all pedestrians, pedal cyclists and motor cyclists are entered into their system, based on the reports from the police and from those involved.

Except in cases of hit-and-run, names of all drivers of motor vehicles (including motor cycles) are included on the submitted forms and are entered into the DMV computerized system. A computer record is included in the file for every person involved in the occurrence (including drivers, passengers, pedestrians, and pedal cyclists) with age and sex identifiers whenever there is a submitted police report. Time and date of occurrence are also included in the DMV computerized record. Names of passengers, pedestrians and bicyclists are not entered into the computerized system.

The record matching and linking of DMV and hospital records was completed in several stages. In the first stage, all exact last name matches between hospital records and driver on the DMV records were obtained where the occurrence date was within two days. This resulted in matching most drivers, as well as relatives of drivers with the same last name. Matches were verified by age, sex, date of occurrence and, where

necessary, manual check with DMV microfilms of all submitted police and motorist reports.

The second stage consisted of identifying possible matches between hospital record names and DMV driver names using "fuzzy" (i.e., artificial intelligence) searching techniques (43). This allowed matching of drivers (and relatives with same last name) where misspellings may have occurred during data entry at the DMV, police reporting, hospital logging or name entry. Address, age, sex and date of occurrence were verified at the same time for these cases. In the event of a discrepancy, microfilm records of the original hard copy report were used for final verification.

The third stage consisted of "fuzzy" searching based on date of occurrence, age, sex and address. The address on the DMV record is the driver's address, and is useful in the event that a person with a different last name lives in the same household as the driver. Possible matches were verified using the DMV microfilms. Motorist reports do not require specification of all passenger names and police reports sometimes do not give passenger names; therefore, not all potential matches could be verified.

The final stage consisted of a computer match between the hospital record and DMV records where sex matched exactly, age was within two years, and time of occurrence from the DMV report was within the four hours prior to that specified on the hospital record. In the event that the hospital record did not specify occurrence time, arrival time was used as a proxy. All possible matches were examined on the DMV microfilm reports to identify true matching records. Matches were identified based on name, age, sex,

address (where given) and time and date of occurrence, and place of occurrence (when specified on the hospital record).

Classification by Road Use Category

Cases were classified into road use categories based on a combination of the linked DMV records and ED records. Cases were identified as occupants of vehicles covered by the Law or in other road use categories based on the DMV classification of vehicle type on the DMV record (which includes pedestrian and pedal cycle). If the category was missing or no matched record existed, a case was classified according to information available on the admission or ED record.

Seating position was first determined by the DMV record, and then by information available on the admission or ED records. In the case of discrepancy between DMV and ED or admission record, the DMV record was given precedence, followed by the admission record, in determining vehicle occupancy seating position. In all cases resulting in death, the Medical Examiner's records, which included law enforcement agency reports, took precedence.

To help ascertain the presence of bias in the results due to lack of specificity of road use category for 13% of the cases in the sample, comparisons were made between the "Other/Unspecified" and "Occupants of Covered Vehicles" road use categories (both years combined).

No differences were found in the distribution of cases by sex between the two road use categories. A significant difference was found in the distribution of age, mainly because of a lower percentage of cases 65 and over in the "Other/Unspecified" category (0.5% vs 5.4%).

"Other/Unspecified" cases had lower severity as measured by ISS, with higher proportions of cases with uncodable ISS 0 (no codable AIS) and ISS 1, and lower proportions in all other ISS categories (2-3, 4-8, 9+).

Injury patterns by body region showed that for almost all regions, a higher proportion of cases in the "Other/Unspecified" category had no injury to a body region. A notable exception to this was cervical strain, where 31% of the "Other/Unspecified" cases had cervical strain, compared to 24% of the occupants of covered vehicles, a statistically significant difference.

These same general patterns held for the comparison of "covered vehicle" drivers with "Other/Unspecified" drivers. However, the comparison of passengers of covered vehicles with "Other/Unspecified" passengers resulted in a deviation from this pattern. In this comparison, there was a higher proportion of cases in the 25-44 year age group in the "Other/Unspecified" group than in the covered group. All other proportions were lower in the "Other/Unspecified" group. There was also no difference in severity patterns between the covered and "Other/Unspecified" passengers, and little difference in body region patterns.

Injury and Outcome Measurements

Injury occurrence rates were based on all eligible cases entering the ED. Occurrence rates for the road use categories consisting of passengers in vehicles covered by the Law under age 10 and 10 years and older were calculated using the appropriate County population values as denominators. For drivers of covered vehicles, the denominator was the 16 year and older population. Total population was used to calculate all other road use

category occurrence rates. One fifteen year old male identified as a driver of a covered vehicle in both hospital and DMV records was excluded from any injury occurrence rate specified as the road use category "drivers of covered vehicles", but not elsewhere.

Case-admission ratios were calculated as the number of cases admitted to a hospital or transferred to another facility, as a percent of all cases excluding those who were dead on arrival at the ED or died after arrival but before admission. Case-fatality ratios were calculated as the ratio of total vehicular injury deaths to the estimated total incidence of vehicular injuries passing through a hospital ED or dying.

Distributions of cases by AIS body region injured, number of body regions affected, and number of AIS codable injuries were based on all cases in the primary sample. Severity of injury analyses, measured using either maximum AIS body region severity or ISS, were calculated as a percent of all cases which have a maximum AIS severity of 1 or greater. This criterion excluded 219 cases (including 103 drivers and 47 passengers in covered vehicles) with a maximum AIS of 0, which were mainly cases with complaints of pain or contact injury or with other ill-defined symptoms not codable by AIS. Seventeen cases with questionable or "rule out" concussive injuries were not included as head injury cases in head injury analyses. Deaths were also excluded from the severity analyses.

In general, occurrence and severity and other outcome analyses are presented for the total population as well as by age, sex, road use category and calendar quarter. For some analyses these breakdowns are not included or categories are combined due to a small number of cases in a particular category.

RESULTS

A sample of 3,488 motor vehicle trauma cases for calendar years 1984 and 1985 was identified from ED records of acute care hospitals serving Suffolk County. After removal of 80 cases defined as non-motor vehicle (ICD-9-CM: not in E810-825), 86 cases with "normal examination" (ICD-9-CM: V71.4), and 99 cases previously treated in a hospital for the same injury, the remaining 3,223 cases defined the primary sample (Table 1). These cases had been sampled in 13 week quarters by ED arrival date in accordance with a time stratification schema (Table 2). Results presented in this section compare pre-law 1984 patterns with those of post-law 1985; stated results are statistically significant at the $p < .05$ level. Potentially important patterns are also included, although they are stated as being not statistically significant at the level tested.

Overall Vehicular Trauma Patterns

Overall crude motor vehicle injury occurrence rates were virtually the same for 1984 and 1985 (Table 3). Increases in vehicular injury case-admission ratios for each sex and both sexes combined were seen in 1985 compared to 1984 (Table 4) and crude fatality rates and case-fatality ratios generally declined in 1985 compared to 1984 (Table 5, 6). The largest fatality rate decrease, 43 percent, was observed in the first quarter of 1985.

By AIS 85-EM coding criteria, the proportion of cases with one or more injuries to the head, face and forehead decreased by 12, 15, and 17 percent, respectively, in 1985 compared to 1984 (Table 7) while the proportion of cases with cervical strain increased 17 percent. Of all

sample cases, 219 (7%) had no AIS codable injury (Table 8). There was essentially no difference in the proportion of these cases between 1984 and 1985 overall or when inspected by road use category.

More detailed analyses of overall vehicular trauma patterns in Suffolk County were done by age, sex and calendar quarter. These analyses are presented in Appendix A.

Road Use Patterns

Of the cases in the sample subset that excludes non-traffic collisions (E817, E820-825), 80 percent were matched with DMV crash reports (Table 9). The cases were assigned to road use categories based on DMV reports, hospital records, or Suffolk County Medical Examiner's reports. Seventy-two percent of all cases were identified as being occupants of vehicles covered by the NYS Seatbelt Use Law, and 92 percent of the occupants in those covered vehicles were also covered by the Law (i.e., drivers, front seat passengers of all ages, and rear seat passengers under 10 years of age). Thirteen percent of all cases were assigned to one of the "Other/Unspecified" road use categories. For both emergency department (outpatient) and admission (inpatient) cases, over 95 percent of the occupants covered by the Law were matched with DMV reports (Table 9). Among occupants of vehicles covered by the Law, persons 10 years and older with an unspecified seating position comprised the group with the lowest proportion of matched records. With the exception of two pedestrians, all persons who died as a result of motor vehicle related injuries (E810-816, E818, E819) were matched with DMV reports.

Occurrence

For all road use categories including those covered by the Law, overall injury occurrence rates were essentially the same in 1984 and 1985 (Table 10). For drivers of vehicles covered by the Law, the occurrence rate decreased by 20 percent in the first quarter of 1985 compared to that quarter in 1984 (Table 11). For children under 10 years of age who were not identified as front seat passengers, a small but significant increase in vehicular injuries was observed in the first quarter of 1985. For occupants of vehicles not covered by the Law, a decrease in the first quarter of 1985 was followed by an increase in the second quarter. A small increase was also seen in the fourth quarter of 1985 for drivers of "Other/Unspecified" vehicles and for occupants of vehicles covered by the Law with unknown seating position who were 10 years and older.

Accounting for an increase in exposure to the number of motor vehicles registered in Suffolk County gave essentially the same results for overall injury occurrence by road use category (Table 12). However, significant decreases in occurrence were seen for all covered occupants in the first and third quarters (Table 13). The fourth quarter increase for all occupants of covered vehicles was not significant in this analysis. In addition, for all vehicular trauma cases there were significant decreases in the first and third quarters.

Admissions

For covered occupants, case-admission ratios were similar in both years (Table 14). Increases in case-admission ratios were seen for motor cyclists and passengers in "Other/Unspecified" vehicles; the case-

admission ratio for motor cyclists more than tripled in 1985. There was also a significant increase in admissions for motor cyclists during the third quarter of 1985 (Table 15).

Fatalities

There were no significant changes in fatality rates or case-fatality ratios by road use category between 1984 and 1985, although both decreased for all occupants covered by the Law in 1985 (Table 16, 17). The largest decreases in the case-fatality ratios for covered occupants were seen for drivers in the first and second quarters, and for front seat passengers in the first and fourth quarters of 1985 (Table 18). However, none of these decreases were significant.

AIS Body Regions

Number of Diagnosed Injuries:

There was a decrease in the number of injuries to drivers of covered vehicles who were treated and released from hospital emergency departments from 1984 to 1985 as measured by the percent of cases with 3 or more AIS codable injuries (Table 19). There were decreases for both males and females, although only the females showed a significant change. The mean number of injuries per treated and released driver also decreased significantly, from 2.1 in 1984 to 1.9 in 1985. A similar analysis was done for drivers who were admitted. There was no difference in the number of injuries on the ED record from 1984 to 1985, indicating that the difference for the treated and released cases was not the result of changes

in hospital admission procedures regarding the number of diagnosed injuries.

In covered vehicles, front seat passengers who were treated and released also showed a sharp decline in the number of injuries. In 1985 there were large decreases in the number of injuries to passengers under age 10 in rear or unknown seating positions, although males in this road use category experienced no remarkable change. Of the road use categories not covered by the Law, only pedal cyclists showed a significant decrease.

Number of Body Regions with Diagnosed Injuries:

A comparison of the number of AIS body regions injured was made for treated and released cases by road use category. The AIS body region "External" was not included since AIS 85 "External" injuries were coded using AIS 85-EM and reassigned to the body region injured (42). Drivers of covered vehicles showed a significant decrease in the number of body regions affected (Table 20). For these drivers there were consistent sharp declines for each sex separately, although only the decrease for females was statistically significant. Rear/unspecified passengers of covered vehicles who were under age 10 showed sharp decreases in 1985, but these decreases were not significant. Pedal cyclists and pedestrians were the only non-covered road use categories which showed significant differences between 1984 and 1985, with both road use categories showing decreases in 1985.

Severity Levels

The severity of trauma, as measured by the proportion of cases with ISS values 4 and above, 9 and above, and 16 and above, showed remarkable similarity in the pre and post-law years for occupants of vehicles covered by the Law (Table 21). Among the categories not covered by the Law, only motor cyclists showed a significant change in 1985; the proportion of cases with an ISS value 9 or above tripled.

As expected, patients who were treated and released from an emergency department were not represented in the highest ISS group (Table 22). For drivers who were admitted, there were lower proportions of cases with high ISS values in 1985; however, none of these was significant (Table 23).

Drivers and Front Passengers in Vehicles Covered by the Law

Drivers and front passengers in vehicles covered by the Law made up the majority (65%) of vehicular injury trauma cases (Table 9) and were also the two largest road use categories affected by the Law. Therefore, more detailed analyses of these two groups are presented.

Occurrence

Occurrence rates per 1,000 population for drivers of covered vehicles decreased in 1985 for ages under 20, and increased for ages 65 and over (Table 24). Between ages 30 and 64, occurrence rates decreased for most 5 year age groups. There were significant decreases for ages 18-19 and 35-39. This same pattern held for occurrence rates per 1,000 licensed drivers in Suffolk County (Table 25).

There were no significant changes in occurrence rates for any age group for front seat passengers (Table 26). However, all ages under 30 showed a decrease in occurrence, as well as ages 55 and over.

Admissions

No pattern was seen for age-specific case-admission ratios for drivers of covered vehicles, and there were no significant increases or decreases in 1985 (Table 27). Front passenger case-admission ratios increased in 1985 for almost all age groups and there were significant increases for both sexes combined and males in the 15-19 year age group (Table 28).

Fatalities

For drivers of covered vehicles, age-specific fatality rates and case fatality ratios decreased for all age groups under 20 and 65 and over, although none was significant (Table 29, 30). For the age group 40-44, both outcome measures showed a significant increase in 1985. This same pattern emerged for fatality rates per 1,000 licensed drivers in Suffolk County. For front passengers there were no significant differences in fatality patterns by age (Table 31, 32), although the fatality rate decreased in 1985 for every age group and the case-fatality ratio decreased for every age group except 65 and over.

AIS Body Regions

Annual Patterns:

Changes in injury patterns were seen in 1985 compared to 1984 for drivers and front seat passengers in vehicles covered by the Law. In 1985

the proportion of drivers with one or more injuries to the head, face, and forehead decreased 18, 17, and 20 percent, respectively (Table 33). Decreases were also seen in head injuries among male drivers and facial and forehead injuries among female drivers. In contrast, facial fractures increased for both male and female drivers, although not significantly. Cervical strain injuries, which comprised most of the injuries to the spine, increased 35 percent for all covered drivers in 1985.

For front seat passengers in 1985 head injuries also decreased, although not significantly (Table 33). A significant 30 percent decrease was seen for facial injuries. Rib fractures more than tripled, and lung injuries showed a small but significant increase.

An examination of the distribution of facial fractures by anatomic location showed that jaw, alveolar, teeth, and orbit fractures more than tripled for both male drivers and male front passengers. Nasal fractures increased for male drivers, but the increase was not significant.

Changes in the proportion of drivers and front seat passengers in covered vehicles with one or more injury to an AIS body region were also inspected by age. For drivers, the proportion with injuries to those body regions generally associated with seat belt usage showed changes which were consistent across all age groups (Table 34A-C). Decreases were seen in the percent of drivers with head injuries in the 16-19, 20-49 and 50+ age groups, with significant decreases in the 20-49 age group. Forehead injuries also decreased in each of these age groups, although none was significant. Cervical strain increased in each, with significance being attained in 20-49 age group.

Changes in body region injury patterns were remarkably consistent for head and face injuries to front passengers across the age groups under 20, 20-49, and 50 and over (Table 35A-C). Although head injuries decreased for each of these groups, none was significant. Facial injuries decreased in each group, with significant reductions of 35 percent and 58 percent, respectively, for the two older age groups.

Quarterly Patterns:

A significant decrease in head injuries to drivers was seen in the first quarter of 1985 (Table 36A) when observed seatbelt usage peaked. This downward shift in head injuries continued in the remaining quarters of 1985 (Table 36B-D), although none was significant. Facial injuries to drivers also decreased throughout the year, with the first and fourth quarters being statistically significant. Facial fractures were consistently higher in all four quarters of 1985, although significance was not demonstrated in any quarter. Post-law increases in cervical strain injuries to drivers were seen in each quarter, and were significant in the first and fourth quarters. For male drivers, there were significant increases in thoracic injuries during the second quarter and in neck injuries during the third quarter of 1985.

For front seat passengers covered by the Law, head injuries decreased in the first three quarters and increased in the fourth quarter of 1985 (Table 36A-D), but none was significant. For facial injuries, both sexes combined and females experienced a significant 46 and 50 percent reduction, respectively, in the third quarter of 1985; decreases were also observed in the other quarters, but were not significant. A relatively large increase

in abdominal injuries observed in the last quarter was statistically significant.

Multivariate Analysis: First Quarter

It has been shown that a logistic regression model can be used to evaluate injury patterns in a multivariate approach (44). This allows for identification of interaction and correlation between injured body regions. For this analysis, only drivers injured in the first quarters of 1984 and 1985 were used. Nine AIS body region categories were included: head, three mutually exclusive subcategories of face injuries (forehead, facial fractures and all other facial injuries), thorax and abdomen combined, neck and cervical strain combined, all other spine, upper extremities and lower extremities. Three separate facial categories were used because facial fractures had been observed to increase when a seat belt use law was implemented in the United Kingdom (6) while forehead injuries decreased (Table 36A). Neck and cervical strain injuries both increased after the law went into effect (Table 36A), but neck injuries were too few to be included separately. Thorax and abdomen injuries were also too few to be considered separately. "External" injuries which could not be reclassified to a body region under AIS 85-EM were not included because of their lack of specificity.

The logistic model showed that the relative risk of sustaining head injuries decreased by nearly one-half (Table 37, column 1), facial fractures tripled, and neck/cervical strain injuries doubled. No other category showed statistical significance. These results were based on a model with all factors included and no interactions present. In contrast,

univariate analysis only identified the head injury decrease and neck/cervical strain increase (Table 37, column 2).

Significant interactions in a logistic regression model would indicate changes in combinations of injuries between 1984 and 1985. There was a strong indication of a (head)*(spine) interaction term and a weaker indication of other interactions [(forehead)*(head), (forehead)*(other face), and (forehead)*(upper extremities)]. To evaluate the strength of the interactions, logistic models were developed by including interaction terms and doing backward deletion of non-significant until all remaining terms in the model were significant. A hierarchical structure was maintained in the model similar to that used in loglinear modeling.

Two initial models were used for the stepwise process, and they resulted in different final models. The first model started with all nine individual injury categories and the (head)*(spine) interaction term. The final model showed a decrease in risk of head injuries and a decrease in the risk of the combination of head and other spine injuries (Table 38). The risk of sustaining a combination of head and other spine injuries decreased to one-fifth of the pre-law level. There was an increase in the risk of neck/cervical strain injuries and in the risk of other spine injuries not associated with a head injury. The estimated risk of neck/cervical strain injuries doubled.

The second model included the (head)*(spine) interaction as well as the three forehead interaction terms specified above. This led to a final model where risk of head (only), forehead (only) and combinations of forehead and head injuries decreased. Risk of head only and forehead only injuries decreased by more than half, while risk of sustaining a

combination of the two decreased somewhat less. Risk of neck/cervical strain injuries was again estimated to have doubled after the law went into effect.

No significant changes in body region patterns were seen for the front seat passengers in the first quarter using either univariate tests (Table 36A) or logistic regression.

Severity

Although AIS severity levels for all drivers of covered vehicles were similar for 1984 and 1985, inspection of severity levels by age and sex indicated pre and post Law changes in severity (Table 39). The proportion of drivers with a maximum AIS severity level three or greater decreased significantly for both sexes in the 16-19 and 50+ age groups. However, in the 20-49 group AIS three or greater level injuries increased, but not significantly. For females, there was a significant increase for the 20-49 year group and a significant decrease in the 50+ age group. Similar age-specific patterns were observed using the percent of cases with ISS 10+ as a measure of greater severity; the only significant change was a decrease for both sexes in the 50+ age group.

In contrast, severity levels as measured by AIS or ISS increased for almost all age and sex combinations for front passengers. Significant increases occurred for both sexes combined and males under age 20, and overall for both sexes combined (Table 40). The only decrease, males 20-49 years, was not significant.

Rear Passengers in Vehicles Covered by the Law

Injury patterns for rear seat passengers under age 10, the third road use category covered by the Law, were analyzed separately. Prior to the Law, children under age 4 had already been covered by the Child Restraint Use Law. In the 1984 and 1985 combined sample, 26 children ages 4-9 years were injured while in a rear seat of a covered vehicle. Four of these children sustained concussive injuries in 1984 and none in 1985, which was a statistically significant decrease. In contrast, no statistical differences were found in concussive injuries between 1984 and 1985 in children under age 4 years who occupied a rear seat.

DISCUSSION

During October of 1984, baseline observed seat belt usage in Suffolk County was 16 percent. A fourfold increase in usage was observed in January 1985, when the law was first enforced; in April of that year observed usage declined to 54 percent and then in September to 44 percent (Figure 2). The initial sharp increase in usage patterns during the first quarter of 1985 was coupled with significant changes in injury severity patterns, as measured by the distribution of anatomic injury by body region. In 1985 compared to 1984 decreases in head, face, and forehead injuries to drivers and front seat passengers in vehicles covered by the Law were observed. Drivers sustained significant increases in cervical strain injuries. Front seat passengers experienced an increase in lung injuries and a three-fold increase in rib fractures during post-law 1985.

The sharpest decreases in head injuries were seen for covered drivers and front seat passengers during the first quarter of 1985, when observed seatbelt usage peaked at over 60 percent. Both male and female drivers experienced an increase in facial fractures and an increase in cervical strain during the same quarter. Interestingly, an overall reduction in facial fractures was observed for front seat passengers during that period.

For drivers and front seat passengers, occurrence and outcome were inspected by five year age groups. It is noteworthy that inspection of age-specific rates and outcome measurements indicated a natural shift in injury patterns for drivers, between three age groups: under 20 years of age, 20 through 49, and over 49 years.

For drivers in 1985, the proportion of cases with head, brain and forehead injuries decreased and cervical strain increased within each of the three age groups. Although a change in severity was not demonstrated for all ages combined, severity levels decreased for younger (under age 20) and older (age 50 and above) drivers in vehicles covered by the Law. One possible explanation for the pattern of decreasing severity in the extreme age groups and no significant change in the middle age group is the "cascading" phenomenon wherein decreases at one level of injury severity are masked by changes at other levels (e.g., from severe to moderate or moderate to mild). Following this analogy, increases in the occurrence rates of minor to moderate injuries for cases over 49 years of age could cause an apparent decrease in severity for that age group; similarly, a drop in occurrence of minor injuries for ages 20 through 49 could cause an apparent increase in severity. These results would be consistent with information that current restraint systems are more effective in controlling moderate to minor injuries resulting from injury events occurring at lower energy transformation levels rather than higher energy transformation levels. To provide further evidence in support of this explanation it would be necessary to know the proportion in each age group that had buckled up, in order to control for restraint system usage.

The reduction in concussive injuries to children 4 through 9 years of age, who occupied rear seats, was noteworthy. This statistically significant finding was based on a change from 4 cases in 1984 to none in 1985. In contrast, no similar change was observed among children under age 4 who were in the age group covered by the Child Restraint Law already in effect prior to 1984, requiring use of infant and toddler car seats.

This suggests increased compliance in the targeted age group, 4-9 year old rear seat occupants, had been achieved as a result of promulgating the new Law in 1985. Because of the small number of cases, this observation should be viewed with caution, pending confirmation in other studies.

The findings of this study are consistent with the hypothesis that increased three point restraint system usage among front seat occupants is associated with reduced head and forehead contact in the windshield area, but increased facial contact with a steering wheel. Similarly, the increase in cervical strain and rib fractures are also consistent with an increase in restraint system usage.

Collectively, these observations are consistent with the changes in injury patterns reported by Rutherford, Hayes and their colleagues following the introduction and enforcement of a seatbelt law in the United Kingdom (6). In Albany, New York, Rood and her colleagues noted that enforcement and publicity about the New York State Law appeared to be associated with an approximate 120 day cycle of increased seatbelt use before declining. Findings from these analyses of pre- to post-law changes are consistent with Rood's observations. The shifts in injury patterns in Suffolk County were most pronounced during the first quarter of 1985 and began to decline in the second quarter.

These changes in injury occurrence patterns by anatomic site, especially those involving the head, neck, and cervical spine, need to be investigated further. In this study, the potential for head injury, and possibly threshold brain injury, changed significantly during the period following the passage and enforcement of the Law when belt usage was highest. The data point to the need to conduct research specifically aimed

at establishing a neck injury criteria to guide the design of restraint systems in order to achieve reductions in head injuries without concomitant increases in cervical spine injuries. In addition, steering wheel involvement needs to be reviewed further in view of increases in certain facial fractures among drivers of covered vehicles. There is an urgent need to determine the effectiveness of supplemental airbags, as soon as practicable, as an intervention that can further reduce head and brain injuries and can reverse the increases of facial injuries without concomitant increases in other injuries. Changes resulting from the use of automatic belt systems need to be evaluated similarly.

Several potential confounding factors that can influence the interpretation of the results in this type of investigation were examined to determine if they varied between 1984 and 1985. In 1985 compared to 1984, the number of persons involved in motor vehicle crashes increased six percent (Table 41). Official estimates of vehicle miles traveled daily in New York State increased from 238.4 million miles to 248.0 million miles (45); Suffolk County traffic counts on county-maintained roads showed an increase of 2.5 percent for the four western towns and an increase of 5.0 percent for Brookhaven town and the five eastern towns (46). Total licenses on file for Suffolk County residents increased 2.2 percent (47), and total paid motor vehicle registrations increased 4.7 percent (48). Each of these factors represents a potential increase in exposure. Adjustment for selected exposure factors in determining occurrence rates has been shown to effect the interpretation of results. For example, significant changes were demonstrated for some occurrence rates after adjustment for exposure (Table 11, 13).

Resource allocation for police enforcement of traffic laws including driving while intoxicated and speed limits were generally the same for both years (49). The average speeds in New York State for 1984 and 1985 were essentially the same (55.8 mph in 1984 and 56.4 mph in 1985) (50).

In the aggregate, potential confounding factors that are associated with increased exposure to the risk of motor vehicle injury can work against a hypothesis that the Law is efficacious. These include an increased number of crashes, increased number of vehicles on the road, and increased vehicle miles traveled. Yet, a number of patterns and trends in support of the hypothesis have been observed in post-law 1985. Thus, the findings reported here for covered occupants should be viewed as lower bound estimates of the positive changes resulting from the promulgation of this Law.

In contrast to Suffolk County, Rhode Island State showed a clear increase in hospital emergency reported vehicular injury incidence rates and case fatality ratios in 1985 compared to 1984 (51). The Rhode Island findings suggest that the New York Law actually may have had greater importance than is reflected in the decline of the morbidity and mortality patterns presented in this study. It is possible that Suffolk County and New York State in general would have experienced increases in occurrence rates and outcome ratios had there been no occupant restraint law and had New York followed the same pattern as Rhode Island.

A number of other potential sources of bias were examined. Cases in the "Other/Unspecified" road use category were largely unmatched with official crash reports and, therefore, could not be assigned to a more

specific category. These cases were compared with all other road use categories combined for both years. The "Other/Unspecified" cases were comprised of a lower proportion of persons under 16 years and over 64 years of age, and a higher proportion of persons ages 25-44 years; the distribution by gender was the same; and the cases in this group sustained a significantly higher proportion of minor injuries, defined as ISS equals 1, and a lower proportion with higher ISS values.

Anatomic injury severity was not codable by AIS in nearly seven percent of the cases (Table 8). An examination of these cases for potential bias revealed no differences between years for the following factors: age, sex, road use category, calendar period, and residency status. Inspection of the records suggests most would have been classified as minor injuries with low severity. Inspection of cases which were not AIS codable but which had an ICD-9-CM N codable injury, especially N854 (head injury, not further specified), showed no differences between 1984 and 1985.

The levels of maximum AIS and ISS used to identify severity were chosen so that there would be sufficient cases at these levels to identify differences if any existed, and to differentiate between "minor/moderate" injuries and "serious" injuries, as defined by AIS (30). Using other values of AIS and ISS did not alter the general patterns shown here. Inclusion of deaths in severity analyses also did not affect the results.

The Suffolk/Nassau county line crossover effect is another potential source of bias. Emergency services rescue squads routinely transport cases across the county line, largely from western Suffolk communities bordering Nassau County to hospitals located in Nassau County, but generally not in

the opposite direction. Hospital ED logs and records do not routinely contain sufficient information to identify the place of occurrence or the specific ambulance/rescue/fire or police service transporting a motor vehicle trauma case to the receiving hospital. Hard copies of ambulance run sheets and police crash reports, which routinely identify both the rescue squad and the receiving hospital, were also searched to minimize bias. Twenty-six cases treated in hospitals located in Suffolk County were identified as being transported to the treating facility by Emergency Medical Services units located in Nassau County. All of these cases were removed from the data base when they could not be record-linked to an official crash report from Suffolk County, using the established matching protocol.

Annual projections of motor vehicle trauma occurrence in Suffolk County for 1984 and 1985, based on ED documented and treated cases, are remarkably similar to the occurrence enumerations obtained from official vehicular crash reports. Past studies in Northeastern Ohio (40) and elsewhere have shown underreporting in official vehicular injury statistics, but they were conducted in states without "no fault" insurance laws. Compared to those studies, the higher level of matching hospital reported cases with official crash reports for 1984 and 1985 indicates that reporting policies and administrative procedures used in Suffolk County are effective in reducing these potential discrepancies.

Thus, the study findings suggest that the routinely available official crash reports for Suffolk County have the potential to be used as a highly cost-effective injury case ascertainment resource for incidence surveillance purposes. Moreover, a foundation for combining surveillance

and evaluation methodology applicable to a broad range of vehicular injury intervention programs, such as comparing the three major restraint systems used in the 1990 passenger car model year, may be developed cost-effectively with such a capability. However, hospital and medical record surveillance would remain essential for determining adverse outcomes including severity, temporary and permanent disability, and direct and indirect costs. From methodological and intervention evaluation perspectives, this study demonstrates the importance of linking official crash reports with hospital and medical records.

These findings further show that selected occurrence rates and severity ratios for occupants covered by the Law were measurably reduced after promulgation of the New York State Seat Belt Use Law. The positive effects were more clearly demonstrable during the three month period immediately following promulgation and enforcement when observed belt use peaked at over 60 percent in Suffolk County. Moreover, the positive effects were seen mainly in the reduction of head injuries. It is noteworthy, that extensive research has been conducted over decades to establish criteria, modeling techniques, and physical crash testing procedures in preparation for developing efficacious occupant restraint systems that are designed mainly to protect the head and chest. A similar effort is needed to establish improved neck and cervical spine injury criteria.

There is also need to continue to develop a baseline of information using police-hospital linked data sets and to conduct follow-up investigations on important matters such as determining changes in injury patterns resulting from the introduction of passive occupant restraint

systems and estimating direct and indirect costs for specific anatomic injuries (e.g., head/brain, neck/cervical spine, and multiple trauma).

CONCLUSIONS

Significant benefits have resulted from the promulgation of the New York State seatbelt law when observed restraint usage among covered occupants exceeded 60 percent. These benefits were not as apparent at lower restraint usage levels, although the injury occurrence and severity patterns were similar.

Clear patterns of injury reduction emerged which were highlighted by a decline in severity and shifts in anatomical injury sites, particularly among drivers and front seat passengers. The occurrence of less severe head and facial injuries, which may result in threshold brain injury, decreased after the Law was in effect and enforced. A marked decrease in concussive injuries to children was also observed in the age group not previously covered by the child restraint law. However, two adverse side effects of increased restraint usage were concomitant increases in overall occurrence of mild cervical spine injuries and in facial fractures to drivers.

When restraint usage peaked in the first quarter of 1985, a 13 percent decline in injury occurrence rates was observed for cases treated in hospital emergency departments compared to the same quarter in 1984. If the first quarter pre-post Law decline in occurrence rates had been maintained throughout the entire year, it would have reduced the 1985 annual occurrence rate by 2.7 per 1,000 population (from 21.6 per 1,000 in 1984). To the extent that these findings are applicable to the U.S.

population in general (237.3 million estimated for 1985), it would suggest that 640,000 fewer people would have required treatment in hospital emergency departments for motor vehicle injuries.

In summary the findings of this study demonstrate that restraint use laws are effective in reducing the occurrence and severity of vehicular injuries (52-56), particularly when enforcement coupled with public information produced restraint usage above 60 percent. In addition, a number of these findings are consistent with those reported by Rutherford, Hayes and their colleagues in the United Kingdom (6), especially the overall decrease in brain injury and increase in cervical strain, and the increase in facial fractures to drivers.

RECOMMENDATIONS

The evaluation of the New York State Seat Belt Use Law has resulted in the development of a population representative data base which has been used to study the short-term impacts of this intervention strategy. There are also clear long-term impacts which can be measured using this data base, and every effort should be made to conduct follow-up studies on this cohort to address a number of important issues. These include studying: the sequelae of threshold brain injury, including post-concussive syndrome, and the sequelae of cervical spine injury; the extent of impairment and disability from motor vehicle injuries; and the economic consequences to the injured individual, family, and society. A follow-up study should also be considered to determine the validity of the "cascading" phenomenon.

It is also important to compare the Suffolk County 1984-1985 cohort with a 1990 cohort within the same jurisdiction for three reasons. First,

it will control for environmental and demographic characteristics longitudinally. Second, it will take full advantage of the data that will be available from the 1990 U.S. census in order to develop accurate and precise risk and outcome measures, especially those related to the economic consequences of injury. Third, it is essential to conduct an initial assessment of the relative effectiveness of the three restraint systems (i.e., supplemental air bags, automatic belts and manual belts) available in the 1990 passenger car model year, especially in view of the significantly increased frequency of cervical strain and facial fractures.

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TABLE 1

Type, Number, and Percent of Cases in Motor Vehicle Trauma Primary Sample for Persons Treated in Hospital Emergency Departments Serving Suffolk County, 1984 and 1985 Combined

Type of Case	Number	Percent
All Cases in Sample	3488	100.0
not ICD-9-CM: E810-825	80	2.3
All ICD-9-CM: E810-825 Cases	3408	97.7
Normal Exams - no Injury	86	2.4
All E810-825 Cases with Injury	3322	95.2
Previous Hospital Treatment	99	2.8
Total First Hospital Treatment for Motor Vehicle Injury, E810-825	3223	92.4

TABLE 2

Number of Cases in Primary Motor Vehicle Trauma Sample by Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Period (13 Week Quarter)	1984	1985
First	356	316
Second	403	428
Third	430	387
Fourth	419	484
Annual	1608	1615

TABLE 3

Estimated Motor Vehicle Trauma Cases and Occurrence Rates per 1,000 Population by Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Period (13 Week Quarter)	1984 Total Estimated Cases	1984 Occurrence Rate/1,000 Population	1985 Total Estimated Cases	1985 Occurrence Rate/1,000 Population
First	6,156	4.8	5,464	4.2
Second	6,968	5.4	7,401	5.7
Third	7,435	5.8	6,692	5.2
Fourth	7,245	5.6	8,369	6.5*
Annual	27,803	21.6	27,924	21.5

* $p < .05$

TABLE 4

Estimated Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Sex and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Period (13 Week Quarter)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
First	8.7	10.1	7.5	14.3*	18.7*	10.4
Second	12.4	13.6	11.2	13.3	15.7	10.4
Third	10.3	13.5	7.3	12.4	13.9	10.7
Fourth	7.7	10.4	5.1	7.7	10.3	5.2
Annual	9.8	12.0	7.7	11.6	14.3	8.8

* $p < .05$

TABLE 5

Motor Vehicle Trauma Fatalities per 100,000 Population by Calendar Period, Suffolk County, New York, 1984 and 1985

Period (13 Week Quarter)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
First	3.5	5.1	2.0	2.0*	3.0	1.1
Second	4.6	6.2	3.0	3.9	5.6	2.3
Third	4.0	5.8	2.3	3.9	5.7	2.3
Fourth	3.3	5.4	1.4	3.9	4.9	2.9
Annual	15.4	22.5	8.6	13.7	19.2	8.4

* $p < .05$

TABLE 6

Estimated Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Calendar Period and Sex, Suffolk County, New York, 1984 and 1985

Period (13 Week Quarter)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
First	7.3	10.9	4.0	4.8	7.3	2.5
Second	8.4	10.9	5.9	6.7	8.6	4.5
Third	6.9	10.0	3.9	7.6	9.9	4.9
Fourth	5.9	9.7	2.4	6.0	7.6	4.4
Annual	7.1	10.3	4.0	6.3	8.4	4.1

TABLE 7

Estimated Annual Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex for Cases Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			ANNUAL			
External	16.0	17.1	15.0	14.1	13.7	14.4
Head	32.1	34.1	30.1	28.4*	27.9*	28.8
Face	32.8	33.9	31.8	28.0*	32.0	23.7*
Facial Fractures	2.8	2.5	3.0	3.0	3.0	2.9
Forehead	15.7	16.8	14.8	13.1*	15.3	10.8*
Neck+	2.4	2.0	2.8	2.7	3.2	2.0
Thorax	9.1	10.3	7.9	11.1	12.2	10.1
Abdomen	2.9	3.4	2.3	3.3	3.6	2.9
Spine+	26.9	24.2	29.5	30.8*	26.0	35.8*
Cervical Strain	20.7	17.0	24.3	24.3*	19.4	29.6*
All Other	9.1	10.3	8.0	9.1	9.1	9.1
Upper extremities	25.6	29.4	22.0	24.0	28.0	19.6
Lower extremities	31.8	32.6	31.0	30.1	31.8	28.3
Total No. of Cases	1608	788	820	1615	831	784

[1] Based on AIS 85 Epidemiogical Modification (AIS 85-EM)
+ Cervical Strain coded to AIS body region Spine
* $p < .05$

TABLE 8

Percent Annual Motor Vehicle Trauma Cases by ISS Groups[1] for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

ISS	1984	1985
1	51.0	53.4
2-3	22.9	20.2
4-8	12.6	12.1
9-15	4.2	5.6
16-75	2.3	2.0
Uncodable +	7.0	6.6
Total	100.0	100.0*
Total No. of Cases	1608	1615

[1] ISS computed from AIS severity scores obtained from emergency department diagnoses or inpatient diagnoses where applicable

+ No documented anatomic injury codable by AIS 85

* Column does not sum to 100% due to rounding.

TABLE 9

Number and Percent of Emergency Department Occurrence Cases, Hospital Admission Cases, and Fatalities Matched with New York State Official Department of Motor Vehicle (DMV) Crash Reports by Road Use Category, Suffolk County, New York, 1984 and 1985 Combined

Road Use Category	Emergency Dept. Sample Total	Emergency Dept. % DMV Matched	Admissions Sample Total	Admissions % DMV Matched	Fatalities Total	Fatalities % DMV Matched
VEHICLES COVERED BY THE LAW						
All Occupants	2333	94.8	220	95.5	219	100.0
All Covered Occupants	2152	95.6	205	96.6	192	100.0
Drivers	1602	95.8	155	96.1	155	100.0
Front Passengers	496	95.6	47	97.9	45	100.0
Rear/Unspec. Position Age <10 Years	54	90.7	3	100.0	2	100.0
Rear Passengers 10+ Years	144	97.2	13	92.3	14	100.0
Unspec. Seating Position 10+ Years	37	35.1	2	0.0	3	100.0
ALL OTHER CATEGORIES						
Occupants of Vehicles Not Covered by Law	110	73.6	6	83.3	3	100.0
Motor Cyclists	88	54.5	25	68.0	41	100.0
Pedestrians	124	68.5	43	88.4	88	97.7
Pedal Cyclists	91	80.2	17	100.0	20	100.0
Other/Unspecified Vehicle+						
Drivers	99	6.1	1	0.0	0	
Passengers	74	2.7	5	40.0	1	100.0
Unspec./Other	232	5.6	8	25.0	1	100.0
SUBTOTAL	3151	79.9	325	89.5	373	99.5
Non Collision & Non Traffic (E817, E820-825)	72	0.0	19	0.0	2	0.0
TOTAL (E810-825)	3,223	78.2	344	84.6	375	98.9

+ Within E code range E810-816, 818, 819.

TABLE 10

Estimated Annual Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Road Use Category	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
VEHICLES COVERED BY THE LAW						
All Occupants	15.9	14.6	17.1	15.4	14.5	16.2
All Covered Occupants	14.7	13.8	15.6	14.1	13.2	14.9
Drivers	14.5	15.3	13.8	13.9	14.2	13.7
Front Passengers	3.5	2.2	4.7	3.1	2.3	4.0
Rear/Unspec. Position Age <10 Years	2.0	1.8	0.4	2.9	2.9	1.9*
Rear Passengers 10+ Years	1.1	0.8	0.4	1.2	1.2	0.5
Unspec. Seating Position 10+ Years	0.3	0.1	0.1	0.3	0.3	0.2
ALL OTHER CATEGORIES						
Occupants of Vehicles Not Covered by Law	0.6	1.1	0.3	0.8	1.1	0.6*
Motor Cyclists	0.7	1.1	0.2	0.5	0.9	0.2
Pedestrians	0.9	1.1	0.7	0.8	1.1	0.4
Pedal Cyclists	0.5	0.9	0.2	0.7	1.2	0.2
Other/Unspecified Vehicles+						
Drivers	0.6	0.4	0.7	0.8	0.9*	0.6
Passengers	0.5	0.4	0.5	0.5	0.6	0.5
Unspec./Other	1.5	1.5	1.5	1.6	1.8	1.4
Non Collision & Non Traffic (E817, E820-825)	0.4	0.7	0.2	0.5	0.8	0.2
TOTAL (E810-825)	21.6	21.8	21.4	21.5	22.8	20.3

+ Within E code range E810-816, 818, 819.
* $p < .05$

TABLE 11

Estimated Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Road Use Category and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Road Use Category	1984 Q1	1984 Q2	1984 Q3	1984 Q4	1985 Q1	1985 Q2	1985 Q3	1985 Q4
VEHICLES COVERED BY THE LAW								
All Occupants	3.6	3.9	4.1	4.2	3.2	3.8	3.5	4.9*
All Covered Occupants	3.4	3.6	3.8	3.9	2.9	3.5	3.2	4.5
Drivers	3.5	3.6	3.5	3.9	2.8*	3.7	3.0	4.4
Front Passengers	0.7	0.8	1.0	0.9	0.6	0.6	0.8	1.0
Rear/Unspec. Position Age <10 Years	0.2	0.7	0.6	0.6	0.9*	0.4	0.6	1.1
Rear Passengers 10+ Years	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Unspec. Seating Position 10+ Years	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2*
ALL OTHER CATEGORIES								
Occupants of Vehicles Not Covered by Law	0.2	<0.1	0.1	0.3	<0.1*	0.3*	0.1	0.3
Motor Cyclists	<0.1	0.2	0.3	<0.1	<0.1	0.2	0.2	<0.1
Pedestrians	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.1
Pedal Cyclists	<0.1	0.2	0.2	<0.1	<0.1	0.3	0.3	<0.1
Other/Unspecified Vehicles[+]								
Drivers	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.3*
Passengers	0.1	<0.1	0.1	0.1	0.2	0.2	<0.1	<0.1
Unspec./Other	0.4	0.4	0.3	0.4	0.3	0.4	0.4	0.5
Non Collision & Non Traffic (E817, E820-825)	<0.1	<0.1	0.2	0.2	<0.1	0.2*	0.2	<0.1
TOTAL (E810-825)	4.8	5.4	5.8	5.6	4.2	5.7	5.2	6.5*

[+] Within E code range E810-816, 818, 819.

* $p < .05$

TABLE 12

Estimated Number of Injury Cases per 1,000 Motor Vehicles Registered in Suffolk County by Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Road Use Category	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
VEHICLES COVERED BY THE LAW						
All Occupants	20.4	9.1	11.3	19.1	8.7	10.4
All Covered Occupants	19.0	8.7	10.3	17.5	8.0	9.5
Drivers	14.1	7.1	7.0	13.0	6.3	6.7
Front Passengers	4.5	1.4	3.1	3.9	1.4	2.5
Rear/Unspec. Position Age <10 Years	0.4	0.2	0.2	0.5	0.3	0.3
Rear Passengers 10+ Yrs	1.2	0.4	0.8	1.3	0.6	0.6
Unspec. Seating Position 10+ Years	0.3	<0.1	0.2	0.3	0.1	0.2
ALL OTHER CATEGORIES						
Occupants of Vehicles Not Covered by Law	0.8	0.7	0.2	1.0	0.7	0.4*
Motor Cyclists	0.8	0.7	0.1	0.6	0.5	<0.1
Pedestrians	1.2	0.7	0.5	0.9	0.7	0.3
Pedal Cyclists	0.7	0.5	0.2	0.8	0.7	0.1
Other/Unspecified Vehicles+						
Drivers	0.8	0.3	0.5	0.9	0.5*	0.4
Passengers	0.6	0.2	0.3	0.7	0.3	0.3
Unspec./Other	2.0	1.0	1.0	2.0	1.1	0.9
Non Collision & Non Traffic (E817, E820-825)	0.6	0.4	0.2	0.6	0.5	0.1
TOTAL (E810-825)	27.8	13.6	14.2	26.7	13.7	13.0

+ Within E code range E810-816, 818, 819.
* $p < .05$

TABLE 13

Estimated Number of Injury Cases per 1,000 Motor Vehicles Registered in Suffolk County by Road Use Category and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Road Use Category	1984 Q1	1984 Q2	1984 Q3	1984 Q4	1985 Q1	1985 Q2	1985 Q3	1985 Q4
VEHICLES COVERED BY THE LAW								
All Occupants	4.7	5.1	5.3	5.4	4.0	4.7	4.3*	6.1
All Covered Occupants	4.4	4.7	4.8	5.1	3.6*	4.4	4.0*	5.6
Drivers	3.4	3.5	3.4	3.8	2.6*	3.5	2.8	4.1
Front Passengers	1.0	1.1	1.3	1.2	0.8	0.8	1.0	1.3
Rear/Unspec. Position Age <10 Years	<0.1	0.1	0.1	0.1	0.2*	<0.1	<0.1	0.2
Rear Passengers 10+ Yrs	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Unspec. Seating Position 10+ Years	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2*
ALL OTHER CATEGORIES								
Occupants of Vehicles Not Covered by Law	0.2	0.1	0.1	0.3	<0.1*	0.4*	0.1	0.4
Motor Cyclists	<0.1	0.3	0.4	0.1	0.1	0.2	0.2	<0.1
Pedestrians	0.2	0.4	0.2	0.3	0.2	0.2	0.3	0.2
Pedal Cyclists	<0.1	0.2	0.3	<0.1	<0.1	0.3	0.4	<0.1
Other/Unspecified Vehicles+								
Drivers	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.3*
Passengers	0.2	0.1	0.1	0.2	0.2	0.2	0.1	<0.1
Unspec./Other	0.5	0.5	0.4	0.5	0.3	0.5	0.5	0.6
Non Collision & Non Traffic (E817, E820-825)	<0.1	<0.1	0.3	0.2	<0.1	0.2*	0.2	0.1
TOTAL (E810-825)	6.2	7.0	7.4	7.3	5.2*	7.1	6.4*	8.0

+ Within E code range E810-816, 818, 819.
* p <.05

TABLE 14

Estimated Annual Number of Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Sex and Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Road Use Category	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
	(Percent)					
VEHICLES COVERED BY THE LAW						
All Occupants	9.1	11.1	7.5	9.8	11.4	8.5
All Covered Occupants	9.3	11.1	7.8	9.9	11.7	8.4
Drivers	9.9	11.3	8.4	9.5	12.0	7.1
Front Passengers	7.3	9.9	6.2	12.0	12.3	11.8
Rear/Unspec. Position Age < 10 Years	9.1	10.0	8.3	3.1	0.0	6.3
Rear Passengers 10+ Years	8.8	13.0	6.7	9.2	10.8	7.7
Unspec. Seating Position 10+ Years	0.0	0.0	0.0	9.5	0.0	16.7
ALL OTHER CATEGORIES						
Occupants of Vehicles Not Covered by Law	2.1	2.6	0.0	8.1	10.0	4.5
Motor Cyclists	14.3	14.6	12.5	46.2*	45.5*	50.0
Pedestrians	39.1	36.8	42.3	32.1	30.0	37.5
Pedal Cyclists	17.5	22.6	0.0	19.6	19.0	22.2
Other/Unspecified Vehicles+						
Drivers	0.0	0.0	0.0	1.8	3.2	0.0
Passengers	0.0	0.0	0.0	12.5*	19.0	5.3
Unspec./Other	3.5	5.4	1.8	3.4	4.5	1.9
Non Collision & Non Traffic (E817, E820-825)	18.2	20.8	11.1	33.3	36.7	22.2
TOTAL (E810-825)	9.8	12.0	7.7	11.6	14.3	8.8

+ Within E code range E810-816, 818, 819.
* $p < .05$

TABLE 15

Estimated Number of Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Road Use Category and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Road Use Category	1984 13 Week Quarter Q1	Q2	Q3	Q4	1985 13 Week Quarter Q1	Q2	Q3	Q4
VEHICLES COVERED BY THE LAW								
All Occupants	8.5	10.7	9.6	7.7	13.0	10.5	9.6	7.4
All Covered Occupants	8.7	10.4	10.1	8.0	13.0	10.2	9.6	7.8
Drivers	8.7	10.4	10.7	9.7	11.4	10.8	8.7	7.7
Front Passengers	9.1	8.2	9.2	3.0	19.1	8.3	13.1	9.1
All Other Occupants	5.3	17.2	3.2	3.7	12.1	12.0	7.1	2.3
ALL OTHER CATEGORIES								
Occupants of Vehicles Not Covered by Law	0.0	14.3	0.0	0.0	25.0	8.3	11.1	4.0
Motor Cyclists	0.0	17.6	9.1	33.3	42.9	42.9	53.3*	33.3
Pedestrians	30.8	50.0	50.0	23.5	46.2	42.9	27.8	9.1
Pedal Cyclists	50.0	21.4	11.1	0.0	50.0	26.3	4.2	50.0
Other/Unspecified Vehicles+								
Drivers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
Passengers	0.0	0.0	0.0	0.0	16.7	6.7	28.6	0.0
Unspec./Other	7.1	0.0	4.0	3.4	4.8	6.7	3.2	0.0
Non Collision & Non Traffic (E817, E820-825)	0.0	25.0	26.7	8.3	0.0	35.7	41.7	42.9
TOTAL (E810-825)	8.7	12.4	10.3	7.7	14.3*	13.3	12.4	7.7

+ Within E code range E810-816, 818, 819.
* $p < .05$

TABLE 16

Annual Number of Motor Vehicle Trauma Fatalities per 100,000 Population by Road Use Category, Suffolk County, New York, 1984 and 1985

Road Use Category	1984	1985
VEHICLES COVERED BY THE LAW		
All Occupants	8.8	8.2
All Covered Occupants	8.3	7.3
Drivers	8.2	7.8
Front Passengers	2.0	1.5
All Other Occupants	0.6	0.8
ALL OTHER CATEGORIES		
Occupants of Vehicles Not Covered by Law	<0.1	0.2
Motor Cyclists	1.5	1.7
Pedestrians	4.0	2.8
Pedal Cyclists	0.7	0.8
Other/Unspecified Vehicles	0.2	0.0
Non Collision & Non Traffic (E817, E820-825)	0.2	0.0
TOTAL (E810-825)	15.4	13.7

+ Within E code range E810-816, 818, 819.

TABLE 17

Annual Number of Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Road Use Category, Suffolk County, New York, 1984 and 1985

Road Use Category	1984	1985
VEHICLES COVERED BY THE LAW		
All Occupants	5.5	5.3
All Covered Occupants	5.7	5.2
Drivers	5.6	5.6
Front Passengers	5.8	4.7
All Other Occupants	4.3	4.9
ALL OTHER CATEGORIES		
Occupants of Vehicles Not Covered by Law	1.2	1.9
Motor Cyclists	21.9	31.6
Pedestrians	45.6	36.5
Pedal Cyclists	12.8	12.3
Other/Unspecified Vehicles[+]	0.6	0.0
Non Collision & Non Traffic (E817, E820-825)	3.5	0.0
TOTAL (E810-825)	7.1	6.3

[+] Within E code range E810-816, 818, 819.

TABLE 18

Number of Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Road Use Category and Calendar Period, Suffolk County, New York, 1984 and 1985

Road Use Category	1984 13 Week Quarter				1985 13 Week Quarter			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
VEHICLES COVERED BY THE LAW								
All Occupants	5.1	6.7	5.7	6.6	3.9	5.1	7.3	7.5
All Covered Occupants	5.2	6.4	6.0	5.0	4.0	5.0	6.7	5.0
Drivers	5.3	6.0	6.2	5.1	4.4	4.6	7.7	5.6
Front Passengers	5.2	7.5	5.3	5.2	3.7	7.2	4.7	3.7
All Other Occupants	3.0	9.9	3.7	0.0	1.7	4.6	10.2	4.0
ALL OTHER CATEGORIES								
Occupants of Vehicles Not Covered by Law	0.0	8.2	0.0	0.0	0.0	2.4	6.4	0.0
Motor Cyclists	28.1	29.7	13.0	28.1	16.3	47.2	15.2	71.6
Pedestrians	74.1	24.2	67.4	32.9	30.2	28.1	36.1	54.7
Pedal Cyclists	14.3	16.3	0.0	54.7	28.1	15.0	4.8	28.1
Other/Unspecified Vehicles[+]	0.0	1.2	0.0	1.2	0.0	0.0	0.0	0.0
Non Collision & Non Traffic (E817, E820-825)	0.0	14.3	3.8	0.0	0.0	0.0	0.0	0.0
TOTAL (E810-825)	7.3	8.4	6.9	5.9	4.8	6.7	7.6	6.0

[+] Within E code range E810-816, 818, 819.

TABLE 19

Estimated Percentage of Treated and Released Cases with 3 or More AIS Codable Injuries by Sex and Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Category	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
VEHICLES COVERED BY THE LAW						
All Occupants	29.4	32.1	27.3	22.3*	26.2	19.2*
All Covered Occupants	30.2	32.5	28.3	22.3*	25.9*	19.5*
Drivers	31.1	32.9	29.5	24.4*	27.6	21.1*
Front passengers	26.7	31.5	24.5	18.3*	20.3	17.3
Rear/Unspec. Position Age <10 Years	36.8	25.0	45.5	6.7*	13.3	0.0*
Rear passengers 10+ Years	16.4	25.0	12.2	23.9	31.3	17.1
Unspec. Seating Position 10+ Years	31.3	25.0	33.3	16.7	25.0	10.0
ALL OTHER CATEGORIES						
Occupants of Vehicles Not Covered by Law	13.3	11.4	20.0	17.9	25.7	4.8
Motor/Cyclists	50.0	51.5	42.9	52.4	55.6	33.3
Pedestrians	56.4	75.0	26.7	37.8	40.7*	30.0
Pedal Cyclists	57.6	54.2	66.7	33.3*	31.3	42.9
Other/Unspecified Vehicle+						
Drivers	20.5	18.8	21.4	21.2	24.1	17.4
Passengers	26.5	35.7	20.0	20.0	23.5	16.7
Unspecified/Other	16.7	22.6	10.9	20.5	26.7	13.5
Non-Collision/Non-Traffic (E817, 820-825)	29.6	26.3	37.5	15.4	10.5	28.6
TOTAL (E810-825)	29.5	33.1	26.3	22.9*	27.2*	18.8*

+Within E code range E810-816, 818, 819.
* $p < .05$

TABLE 20

Percentage of Treated and Released Cases with 2 or More Injured AIS Body Regions by Sex and Road Use Category for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Category	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
VEHICLES COVERED BY THE LAW						
All Occupants	39.9	40.2	39.6	34.3*	36.0	33.0*
All Covered Occupants	40.5	40.4	40.6	34.3*	35.9	33.1*
Drivers	41.5	42.0	41.0	34.4*	36.2	32.9*
Front Passengers	37.7	34.2	39.3	37.1	39.1	36.1
Rear/Unspec. Position Age <10 Years	36.8	25.0	45.5	13.3	13.3	13.3
Rear Passengers 10+ Years	27.9	35.0	24.4	35.8	37.5	34.3
Unspec. Seating Position 10+ Years	50.0	50.0	50.0	27.8	37.5	20.0
ALL OTHER CATEGORIES						
Occupants of Vehicles Not Covered by law	28.9	28.6	30.0	25.0	37.1	4.8
Motor/Cyclists	60.0	63.6	42.9	57.1	61.1	33.3
Pedestrians	53.8	62.5	40.0	29.7*	33.3*	20.0
Pedal Cyclists	60.6	62.5	55.6	28.2*	25.0*	42.9
Other/Unspecified Vehicle[+]						
Drivers	22.7	25.0	21.4	30.8	31.0	30.4
Passengers	32.4	35.7	30.0	31.4	35.3	27.8
Unspec./Other	24.1	26.4	21.8	27.7	36.7	17.3
Non-Collision/Non-Traffic (E817, 820-825)	22.2	15.8	37.5	15.4	15.8	14.3
TOTAL (E810-825)	38.7	40.1	37.4	32.9*	35.4	30.5*

[+]Within E code range E810-816, 818, 819.
* $p < .05$

TABLE 21

Percent Motor Vehicle Trauma Cases in Selected ISS Groups
by Road Use Category for Persons Treated in Hospital Emergency Departments
Serving Suffolk County, New York, 1984 and 1985

Road Use Category	ISS 4-75		ISS 9-75		ISS 16-75	
	1984	1985	1984	1985	1984	1985
VEHICLES COVERED BY THE LAW						
All Occupants	18.9	19.0	5.9	7.2	1.9	1.7
All Covered Occupants	19.1	19.1	6.2	7.3	2.1	1.7
Drivers	20.4	19.7	6.5	6.7	2.1	1.3
Front Passengers	14.8	18.1	5.3	9.3	1.6	3.3
Rear/Unspec. Position Age <10 Years	23.8	10.3	4.8	6.9	4.8	0.0
Rear Passengers 10+ Years	15.4	17.1	1.5	4.3	0.0	1.4
Unspec. Seating Position 10+ Years	20.0	19.0	6.7	9.5	0.0	0.0
ALL OTHER CATEGORIES						
Occupants of Vehicles Not Covered by Law	10.5	7.0	5.3	1.8	0.0	0.0
Motor Cyclists	34.7	50.0	12.2	36.8*	4.1	2.6
Pedestrians	46.8	41.2	19.4	21.6	3.2	7.8
Pedal Cyclists	22.5	28.0	12.5	6.0	5.0	0.0
Other/Unspecified Vehicles[+]						
Drivers	10.0	8.0	0.0	2.0	0.0	0.0
Passengers	10.3	19.4	0.0	5.6	0.0	2.8
Unspec./Other	14.1	19.0	3.0	1.0	1.0	0.0
Non Collision & Non Traffic (E817, E820-825)	34.4	48.7	9.4	15.4	3.1	5.1
TOTAL (E810-825)	20.1	20.8	6.5	7.7	2.0	1.7

[+] Within E code range E810-816, 818, 819.
* $p < .05$

TABLE 22

Percent Motor Vehicle Trauma Cases in Selected ISS Groups by Road Use Category for Persons Discharged from Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Road Use Category	ISS 4-75		ISS 9-75		ISS 16-75	
	1984	1985	1984	1985	1984	1985
VEHICLES COVERED BY THE LAW						
All Occupants	10.7	10.5	0.4	1.3*	0.0	0.0
All Covered Occupants	10.8	10.8	0.3	1.4*	0.0	0.0
Drivers	11.5	12.0	0.5	1.4	0.0	0.0
Front Passengers	8.6	7.0	0.0	1.1	0.0	0.0
Rear/Unspec. Position Age <10 Years	11.1	7.1	0.0	3.6	0.0	0.0
Rear Passengers 10+ Years	6.8	8.1	0.0	0.0	0.0	0.0
Unspec. Seating Position 10+ Years	20.0	5.6	6.7	0.0	0.0	0.0
ALL OTHER CATEGORIES						
Occupants of Vehicles Not Covered by Law	8.6	1.9	2.9	0.0	0.0	0.0
Motor Cyclists	22.5	14.3	0.0	0.0	0.0	0.0
Pedestrians	21.1	15.2	2.6	0.0	0.0	0.0
Pedal Cyclists	6.1	10.3	0.0	0.0	0.0	0.0
Other/Unspecified Vehicles+						
Drivers	10.0	4.2	0.0	0.0	0.0	0.0
Passengers	10.3	6.5	0.0	0.0	0.0	0.0
Unspec./Other	9.6	14.1	0.0	0.0	0.0	0.0
Non Collision & Non Traffic (E817, E820-825)	19.2	23.1	0.0	0.0	0.0	0.0
TOTAL (E810-825)	11.2	10.5	0.5	0.9	0.0	0.0

+ Within E code range E810-816, 818, 819.
* $p < .05$

TABLE 23

Percent Motor Vehicle Trauma Admissions in Selected ISS Groups
by Road Use Category for Persons Treated in Hospital Emergency Departments
Serving Suffolk County, New York, 1984 and 1985

Road Use Category	ISS 4-75		ISS 9-75		ISS 16-75	
	1984	1985	1984	1985	1984	1985
VEHICLES COVERED BY THE LAW						
All Occupants	94.3	88.3	57.1	57.7	20.0	16.2
All Covered Occupants	93.9	87.3	59.6	57.8	21.2	16.7
Drivers	94.9	86.3	57.7	54.8	20.5	13.7
Front Passengers	89.5	89.3	68.4	64.3	21.1	25.0
All Other Occupants	100.0	100.0	25.0	60.0	12.5	10.0
ALL OTHER SPECIFIED ROAD USE CATEGORIES	92.3	93.8	59.0	60.4	15.4	10.4
All Other/Unspecified[+]	100.0	100.0	75.0	40.0	25.0	10.0
Non Collision & Non Traffic (E817, E820-825)	100.0	100.0	50.0	46.2	16.7	15.4
TOTAL (E810-825)	94.2	91.2	57.8	56.6	18.8	14.3

[+] Within E code range E810-816, 818, 819.

TABLE 24

Estimated Annual Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Age and Sex for Drivers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
16-17	15.5	19.8	11.0	13.0	16.1	9.9
18-19	42.3	39.3	45.4	30.5*	28.0	33.1
20-24	27.7	26.0	29.3	31.3	30.5	32.1
25-29	19.3	23.0	15.8	22.4	23.8	21.1
30-34	12.5	12.0	12.9	11.4	12.0	10.8
35-39	13.4	12.2	14.4	9.5*	8.0	10.8
40-44	11.1	10.0	12.1	11.6	8.0	14.9
45-49	10.3	6.9	13.6	8.1	6.7	9.5
50-54	11.3	16.4	6.1	9.8	8.9*	10.7
55-59	8.8	9.4	8.2	9.5	11.3	7.7
60-64	5.5	5.1	5.9	5.4	7.9	3.2
65-69	4.1	4.7	3.7	4.8	5.5	4.3
70-74	3.7	5.2	2.7	8.3	11.4	6.2
75-79	7.4	14.2	3.5	9.5	12.0	8.0
80+	3.2	10.5	0.0	3.7	8.2	1.7
All ages	14.5	15.3	13.8	13.9	14.2	13.7

* $p < .05$

TABLE 25

Estimated Motor Vehicle Trauma Occurrence Rates per 1,000 Licensed Suffolk Drivers by Age and Sex for Drivers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
16-17	50.7	57.4	41.6	45.8	50.0	40.2
18-19	49.3	43.6	55.7	35.7*	31.1	41.0
20-24	24.1	21.8	26.4	26.8	25.2	28.4
25-29	17.7	20.3	15.1	20.2	20.6	19.8
30-34	13.7	12.7	14.7	12.4	12.6	12.2
35-39	14.2	12.7	15.5	10.1*	8.4	11.6
40-44	11.1	9.8	12.3	11.8	8.0	15.4
45-49	10.3	6.7	14.0	8.1	6.6	9.6
50-54	10.8	15.0	6.2	9.3	8.1*	10.5
55-59	8.5	8.4	8.7	8.9	9.8	7.9
60-64	5.6	4.5	7.0	5.5	6.9	3.8
65-69	4.9	4.6	5.3	5.5	5.1	6.0
70+	7.8	9.9	4.9	11.5	11.0	12.2*
All ages	15.6	15.2	16.1	14.8	14.0	15.8

* $p < .05$

TABLE 26

Estimated Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Age and Sex for Front Passengers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
<10	1.5	1.3	1.7	1.1	1.1	1.1
10-14	2.9	2.2	3.6	2.1	2.2	2.0
15-19	10.0	6.8	13.3	9.7	7.1	12.5
20-24	6.8	5.8	7.7	6.5	5.6	7.5
25-34	3.4	1.4	5.4	2.6	1.9	3.3
35-44	1.7	1.6	1.7	1.8	1.7	1.8
45-54	2.9	0.5	5.2	3.2	1.0	5.4
55-64	2.2	0.6	3.7	1.7	0.3	3.1
65+	3.1	1.8	3.8	2.4	1.0	3.3
All ages	3.5	2.2	4.7	3.1	2.3	4.0

TABLE 27

Estimated Number of Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Age and Sex for Drivers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
16-17	7.0	7.1	6.7	11.4	13.6	7.7
18-19	12.1	9.3	14.5	7.3	7.9	6.8
20-24	9.2	10.5	8.0	9.9	12.5	7.4
25-29	13.8	19.0	6.5	14.6	19.4	9.5
30-34	5.1	8.3	2.4	9.6	8.1	11.1
35-39	9.6	11.1	8.5	4.9	8.0	2.8
40-44	10.5	16.0	6.3	6.5	9.5	4.9
45-49	9.5	0.0	14.3	17.6	21.4	15.0
50-54	7.3	6.7	9.1	5.7	12.5	0.0
55-59	6.9	12.5	0.0	0.0	0.0	0.0
60-64	6.3	0.0	11.1	0.0	0.0	0.0
65-69	20.0	40.0	0.0	0.0	0.0	0.0
70-74	16.7	33.3	0.0	18.8	33.3	0.0
75-79	10.0	0.0	33.3	23.1	16.7	28.6
80+	20.0	20.0	---	0.0	0.0	0.0
All ages	9.9	11.3	8.4	9.5	12.0	7.1

TABLE 28

Estimated Number of Motor Vehicle Trauma Admissions per 100 Vehicular Injury Cases by Age and Sex for Front Passengers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
<10	6.3	0.0	11.1	8.3	0.0	16.7
10-14	0.0	0.0	0.0	7.7	0.0	16.7
15-19	4.3	4.2	4.4	15.4*	25.0*	9.8
20-24	12.5	23.5	4.3	16.2	20.0	13.6
25-34	12.2	25.0	9.1	3.1	0.0	4.8
35-44	5.6	11.1	0.0	9.5	10.0	9.1
45-54	9.1	0.0	10.0	16.0	0.0	19.0
55-64	0.0	0.0	0.0	9.1	0.0	10.0
65+	9.5	0.0	12.5	11.8	0.0	14.3
All Ages	7.3	9.9	6.2	12.0	12.3	11.8

* $p < .05$

TABLE 29

Fatality Rate per 100,000 Population by Age for Drivers of Vehicles Covered by the Law, Suffolk County, New York, 1984 and 1985

Age (Years)	1984	1985
16-17	8.3	6.5
18-19	10.5	6.5
20-24	4.9	12.9
25-29	8.2	11.0
30-34	9.3	8.1
35-39	7.4	3.6
40-44	1.1	7.5*
45-49	11.3	2.8
50-54	6.4	6.5
55-59	6.8	8.6
60-64	7.9	7.9
65-74	10.8	3.9
75+	19.8	15.4
All ages	8.2	7.8

* $p < .05$

TABLE 30

Estimated Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Age for Drivers of Vehicles Covered by the Law, Suffolk County, New York, 1984 and 1985

Age (Years)	1984 Both Sexes	1985 Both Sexes
16-17	5.4	4.9
18-19	2.5	2.1
20-24	1.8	4.1
25-29	4.2	4.9
30-34	7.4	7.2
35-39	5.5	3.8
40-44	1.0	6.5*
45-49	10.9	3.4
50-54	5.6	6.6
55-59	7.9	9.2
60-64	14.3	14.3
65-69	11.4	4.8
70-74	54.7	7.2
75-79	22.6	13.2
80+	79.8	46.0
All ages	5.6	5.6

* $p < .05$

TABLE 31

Estimated Motor Vehicle Trauma Fatalities per 100,000 Population by Age for Front Passengers of Vehicles Covered by the Law, Suffolk County, New York, 1984 and 1985

Age (Years)	1984	1985
<15	0.3	0.0
15-24	5.0	4.1
25-44	1.2	0.7
45-64	2.1	1.2
65+	3.2	3.1
All ages	2.0	1.5

TABLE 32

Estimated Motor Vehicle Trauma Fatalities per 1,000 Vehicular Injury Cases by Age for Front Passengers of Vehicles Covered by the Law, Suffolk County, New York, 1984 and 1985

Age (Years)	1984	1985
<15	1.7	0.0
15-24	5.8	5.1
25-44	4.9	3.3
45-64	8.0	4.8
65+	10.9	13.4
All ages	5.8	4.7

TABLE 33

Estimated Annual Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex for Drivers and Front Seat Passengers in Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			DRIVERS			
External	16.5	17.6	15.3	13.3	10.4*	16.0
Head	35.2	38.9	31.4	29.0*	29.0*	29.1
Face	35.5	38.4	32.7	29.3*	33.7	25.1*
Facial Fractures	2.7	2.2	3.2	3.9	4.2	3.7
Forehead	17.7	19.3	16.1	14.1*	17.2	11.1*
Neck+	2.0	2.2	1.7	3.0	3.7	2.5
Thorax	9.7	10.3	9.2	11.5	12.8	10.3
Rib Fracture	1.6	2.0	1.2	2.5	2.3	2.7
Lung	0.6	0.5	0.7	0.6	0.5	0.7
Abdomen	2.3	2.9	1.7	2.9	3.7	2.2
Spine	27.4	25.7	29.2	34.9*	30.8	38.7*
Cervical Strain+	21.8	19.3	24.3	29.4*	25.1	33.5*
All Other	9.1	10.0	8.2	8.9	9.1	8.6
Upper extremities	25.1	26.7	23.5	21.9	26.1	18.0
Lower extremities	30.5	29.1	31.9	27.8	27.9	27.6
Total No. of Cases	813	409	404	789	383	406
			FRONT SEAT PASSENGERS			
External	15.3	17.3	14.4	13.6	11.0	15.0
Head	33.7	40.7	30.6	28.9	30.5	28.1
Face	41.0	44.4	39.4	28.5*	32.9	26.1*
Facial Fractures	3.1	3.7	2.8	3.8	3.7	3.9
Forehead	18.8	19.8	18.3	13.2	12.2	13.7
Neck+	3.4	2.5	3.9	1.7	2.4	1.3
Thorax	8.4	9.9	7.8	12.8	11.0	13.7
Rib Fracture	1.1	0.0	1.7	3.8	2.4	4.6
Lung	0.0	0.0	0.0	1.7*	1.2	2.0
Abdomen	2.7	2.5	2.8	5.1	6.1	4.6
Spine	29.9	24.7	32.2	31.9	29.3	33.3
Cervical Strain+	22.6	14.8	26.1	22.6	24.4	21.6
All Other	9.6	16.0	6.7	10.6	7.3	12.4
Upper extremities	19.2	18.5	19.4	22.1	18.3	24.2
Lower extremities	26.8	24.7	27.8	28.9	24.4	31.4
Total No. of Cases	261	81	180	235	82	153

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 34A

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex for Drivers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			DRIVERS, AGE 16-19			
External	11.3	15.7	6.5	13.7	13.3	14.0
Head	38.8	42.2	35.1	35.0	35.0	35.1
Face	43.8	50.6	36.4	32.5	35.0	29.8
Facial Fractures	2.5	1.2	3.9	2.6	1.7	3.5
Forehead	25.0	27.7	22.1	16.2	20.0	12.3
Neck+	1.9	1.2	2.6	3.4	3.3	3.5
Thorax	6.9	4.8	9.1	9.4	10.0	8.8
Abdomen	1.3	2.4	0.0	1.7	1.7	1.8
Spine	22.5	18.1	27.3	27.4	26.7	28.1
Cervical Strain+	16.9	13.3	20.8	20.5	20.0	21.1
All Other	8.1	7.2	9.1	7.7	8.3	7.0
Upper extremities	28.1	30.1	26.0	24.8	23.3	26.3
Lower extremities	24.4	22.9	26.0	29.9	25.0	35.1
Total No. of Cases	160	83	77	117	60	57

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine

TABLE 34B

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex for Drivers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			DRIVERS, AGE 20-49			
External	16.7	16.7	16.7	12.4*	9.1*	15.2
Head	35.5	38.6	32.6	28.0*	26.6*	29.3
Face	33.8	37.1	30.9	30.1	34.1	26.6
Facial Fractures	2.6	2.8	2.5	4.6	4.8	4.5
Forehead	16.3	18.7	14.2	14.8	17.5	12.4
Neck+	1.7	1.6	1.8	3.1	4.4	2.1
Thorax	9.0	11.2	7.1	11.3	13.5	9.3
Abdomen	2.4	2.8	2.1	3.1	3.6	2.8
Spine	30.2	29.5	30.9	36.7*	31.0	41.7*
Cervical Strain+	24.0	21.9	25.9	32.1*	25.4	37.9*
All Other	9.8	11.6	8.2	8.9	9.1	8.6
Upper extremities	24.0	24.7	23.4	20.5	26.6	15.2*
Lower extremities	32.6	31.1	34.0	26.4*	27.4	25.5*
Total No. of Cases	533	251	282	542	252	290

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 34C

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex for Drivers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			DRIVERS, AGE 50+			
External	22.7	23.0	22.2	16.9	12.7	22.0
Head	29.4	36.5	17.8	27.7	32.4	22.0
Face	31.9	28.4	37.8	23.1	31.0	13.6*
Facial Fractures	2.5	0.0	6.7	2.3	4.2	0.0*
Forehead	14.3	12.2	17.8	9.2	14.1	3.4*
Neck[+]	3.4	5.4	0.0	2.3	1.4	3.4
Thorax	16.8	13.5	22.2	14.6	12.7	16.9
Abdomen	3.4	4.1	2.2	3.1	5.6	0.0
Spine	21.8	21.6	22.2	33.8*	33.8	33.9
Cervical Strain[+]	18.5	17.6	20.0	26.2	28.2	23.7
All Other	7.6	8.1	6.7	10.0	9.9	10.2
Upper extremities	26.1	29.7	20.0	25.4	26.8	23.7
Lower extremities	28.6	28.4	28.9	31.5	32.4	30.5
Total No. of Cases	119	74	45	130	71	59

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
[+] Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 35A

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex for Front Seat Passengers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
	FRONT SEAT PASSENGERS, AGE <20					
External	13.6	15.8	12.3	16.7	10.8	20.8
Head	38.8	42.1	36.9	28.9	27.0	30.2
Face	45.6	42.1	47.7	38.9	45.9	34.0
Neck+	4.9	5.3	4.6	2.2	2.7	1.9
Thorax	5.8	5.3	6.2	8.9	8.1	9.4
Abdomen	1.9	0.0	3.1	3.3	5.4	1.9
Spine	23.3	21.1	24.6	25.6	18.9	30.2
Cervical Strain+	17.5	10.5	21.5	17.8	16.2	18.9
All Other	7.8	15.8	3.1	7.8	2.7	11.3
Upper extremities	17.5	15.8	18.5	21.1	24.3	18.9
Lower extremities	22.3	18.4	24.6	26.7	29.7	24.5
Total No. of Cases	103	38	65	90	37	53

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine

TABLE 35B

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex for Front Seat Passengers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			FRONT SEAT PASSENGERS, AGE 20-49			
External	14.7	17.1	13.5	11.5	12.8	10.8
Head	30.3	42.9	24.3	28.8	35.9	24.6
Face	36.7	45.7	32.4	24.0*	23.1*	24.6
Neck[+]	2.8	0.0	4.1	1.9	2.6	1.5
Thorax	7.3	14.3	4.1	13.5	15.4	12.3
Abdomen	2.8	5.7	1.4	7.7	7.7	7.7
Spine	35.8	28.6	39.2	36.5	38.5	35.4
Cervical Strain[+]	30.3	22.9	33.8	28.8	33.3	26.2
All Other	9.2	14.3	6.8	10.6	10.3	10.8
Upper extremities	22.9	22.9	23.0	21.2	12.8	26.2
Lower extremities	28.4	28.6	28.4	28.8	15.4	36.9
Total No. of Cases	109	35	74	104	39	65

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
[+] Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 35C

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex for Front Seat Passengers of Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
	FRONT SEAT PASSENGERS, AGE 50+					
External	20.4	25.0	19.5	12.2	0.0	14.3
Head	30.6	25.0	31.7	29.3	16.7	31.4
Face	40.8	50.0	39.0	17.1*	16.7	17.1*
Neck+	2.0	0.0	2.4	0.0	0.0	0.0
Thorax	16.3	12.5	17.1	19.5	0.0	22.9
Abdomen	4.1	0.0	4.9	2.4	0.0	2.9
Spine	30.6	25.0	31.7	34.1	33.3	34.3
Cervical Strain+	16.3	0.0	19.5	17.1	16.7	17.1
All Other	14.3	25.0	12.2	17.1	16.7	17.1
Upper extremities	14.3	12.5	14.6	26.8	16.7	28.6
Lower extremities	32.7	37.5	31.7	34.1	50.0	31.4
Total No. of Cases	49	8	41	41	6	35

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 36A

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex and Calendar Period for Drivers and Front Seat Passengers in Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	First Quarter 1984 Both Sexes	Male	Female	First Quarter 1985 Both Sexes	Male	Female
DRIVERS						
External	10.7	11.9	9.5	13.3	8.3	17.4
Head	40.8	47.5	33.7	27.8*	29.2*	26.7
Face	39.8	43.6	35.8	28.5*	37.5	20.9*
Facial Fractures	3.1	2.0	4.2	6.3	6.9	5.8
Forehead	22.4	22.8	22.1	15.2	19.4	11.6
Neck+	2.6	3.0	2.1	3.8	5.6	2.3
Thorax	8.7	10.9	6.3	8.2	6.9	9.3
Abdomen	1.5	2.0	1.1	3.8	4.2	3.5
Spine	25.0	21.8	28.4	36.1*	30.6	40.7
Cervical Strain+	16.3	13.9	18.9	29.1*	26.4*	31.4
All Other	10.2	8.9	11.6	10.1	11.1	9.3
Upper extremities	20.9	17.8	24.2	17.1	19.4	15.1
Lower extremities	29.1	25.7	32.6	29.1	25.0	32.6
Total No. of Cases	196	101	95	158	72	86
FRONT SEAT PASSENGERS						
External	7.3	10.0	5.7	12.5	12.5	12.5
Head	36.4	45.0	31.4	25.0	43.8	15.6
Face	40.0	40.0	40.0	33.3	37.5	31.3
Facial Fractures	5.5	5.0	5.7	4.2	6.3	3.1
Forehead	20.0	15.0	22.9	12.5	12.5	12.5
Neck+	1.8	0.0	2.9	2.1	6.3	0.0
Thorax	12.7	10.0	14.3	18.8	25.0	15.6
Abdomen	0.0	0.0	0.0	6.3	12.5	3.1
Spine	32.7	35.0	31.4	33.3	31.3	34.4
Cervical Strain+	23.6	25.0	22.9	18.8	31.3	12.5
All Other	16.4	25.0	11.4	16.7	6.3	21.9
Upper extremities	14.5	25.0	8.6	22.9	6.3	31.3*
Lower extremities	34.5	45.0	28.6	45.8	31.3	53.1*
Total No. of Cases	55	20	35	48	16	32

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 36B

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex and Calendar Period for Drivers and Front Seat Passengers in Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	Second Quarter 1984			Second Quarter 1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
DRIVERS						
External	17.3	17.0	17.7	9.9*	7.7*	12.0
Head	33.2	36.8	29.2	33.0	30.8	35.2
Face	29.7	26.4	33.3	28.8	31.7	25.9
Facial Fractures	3.0	0.9	5.2	3.8	1.9	5.6
Forehead	14.9	15.1	14.6	11.8	17.3	6.5
Neck+	1.5	1.9	1.0	1.4	1.9	0.9
Thorax	9.4	7.5	11.5	13.7	18.3*	9.3
Abdomen	2.0	1.9	2.1	2.8	2.9	2.8
Spine	27.7	29.2	26.0	28.3	22.1	34.3
Cervical Strain+	22.3	23.6	20.8	25.5	19.2	31.5
All Other	10.4	11.3	9.4	6.1	5.8	6.5
Upper extremities	28.2	27.4	29.2	24.5	26.0	23.1
Lower extremities	31.2	26.4	36.5	32.5	33.7	31.5
Total No. of Cases	202	106	96	212	104	108
FRONT SEAT PASSENGERS						
External	13.1	11.8	13.6	12.5	12.5	12.5
Head	34.4	47.1	29.5	31.3	29.2	33.3
Face	37.7	23.5	43.2	31.3	33.3	29.2
Facial Fractures	3.3	0.0	4.5	6.3	8.3	4.2
Forehead	19.7	17.6	20.5	12.5	8.3	16.7
Neck+	4.9	5.9	4.5	2.1	4.2	0.0
Thorax	8.2	5.9	9.1	14.6	12.5	16.7
Abdomen	6.6	5.9	6.8	6.3	4.2	8.3
Spine	24.6	17.6	27.3	29.2	29.2	29.2
Cervical Strain+	18.0	5.9	22.7	22.9	25.0	20.8
All Other	6.6	11.8	4.5	10.4	8.3	12.5
Upper extremities	24.6	11.8	29.5	14.6	8.3	20.8
Lower extremities	21.3	5.9	27.3	18.8	12.5	25.0
Total No. of Cases	61	17	44	48	24	24

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 36C

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex and Calendar Period for Drivers and Front Seat Passengers in Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	Third Quarter 1984 Both Sexes	Male	Female	Third Quarter 1985 Both Sexes	Male	Female
			DRIVERS			
External	17.3	19.4	15.2	15.1	13.0	17.5
Head	31.5	32.7	30.3	25.0	26.1	23.8
Face	32.5	34.7	30.3	30.2	32.6	27.5
Facial Fractures	2.0	2.0	2.0	3.5	4.3	2.5
Forehead	16.2	16.3	16.2	15.7	17.4	13.8
Neck+	1.5	1.0	2.0	4.7	7.6*	1.3
Thorax	11.7	15.3	8.1	12.2	12.0	12.5
Abdomen	2.0	4.1	0.0	3.5	3.3	3.8
Spine	31.5	28.6	34.3	37.2	34.8	40.0
Cervical Strain+	25.9	19.4	32.3	27.9	21.7	35.0
All Other	10.7	15.3	6.1	14.0	17.4	10.0
Upper extremities	27.9	29.6	26.3	26.2	33.7	17.5
Lower extremities	29.9	29.6	30.3	24.4	23.9	25.0
Total No. of Cases	197	98	99	172	92	80
			FRONT SEAT PASSENGERS			
External	15.6	17.4	14.8	14.8	11.8	15.9
Head	36.4	39.1	35.2	24.6	11.8	29.5
Face	45.5	56.5	40.7	24.6*	35.3	20.5*
Facial Fractues	1.3	4.3	0.0	3.3	0.0	4.5
Forehead	19.5	21.7	18.5	14.8	17.6	13.6
Neck+	3.9	0.0	5.6	1.6	0.0	2.3
Thorax	9.1	13.0	7.4	13.1	5.9	15.9
Abdomen	3.9	4.3	3.7	1.6	0.0	2.3
Spine	32.5	13.0	40.7	32.8	11.8	40.9
Cervical Strain+	24.7	8.7	31.5	27.9	11.8	34.1
All Other	7.8	4.3	9.3	4.9	0.0	6.8
Upper extremities	16.9	13.0	18.5	34.4*	47.1*	29.5
Lower extremities	29.9	26.1	31.5	29.5	17.6	34.1
Total No. of Cases	77	23	54	61	17	44

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 36D

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex and Calendar Period for Drivers and Front Seat Passengers in Vehicles Covered by the Seatbelt Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	Fourth Quarter 1984 Both Sexes	Male	Female	Fourth Quarter 1985 Both Sexes	Male	Female
			DRIVERS			
External	20.2	22.1	18.4	15.0	12.2*	17.4
Head	35.3	38.5	32.5	29.1	29.6	28.8
Face	39.9	49.0	31.6	29.6*	33.9*	25.8
Facial Fractures	2.8	3.8	1.8	2.8	4.3	1.5
Forehead	17.4	23.1	12.3	14.2	15.7	12.9
Neck+	2.3	2.9	1.8	2.8	0.9	4.5
Thorax	9.2	7.7	10.5	11.3	12.2	10.6
Abdomen	3.7	3.8	3.5	2.0	4.3	0.0*
Spine	25.7	23.1	28.1	38.1*	35.7*	40.2*
Cervical Strain+	22.5	20.2	24.6	34.0*	32.2*	35.6
All Other	5.5	4.8	6.1	6.9	4.3	9.1
Upper extremities	23.4	31.7	15.8	19.8	24.3	15.9
Lower extremities	31.7	34.6	28.9	25.1	27.8	22.7
Total No. of Cases	218	104	114	247	115	132
			FRONT SEAT PASSENGERS			
External	23.5	28.6	21.3	14.1	8.0	17.0
Head	27.9	33.3	25.5	33.3	36.0	32.1
Face	39.7	52.4	34.0	26.9	28.0	26.4
Facial Fractures	2.9	4.8	2.1	2.6	0.0	3.8
Forehead	16.2	23.8	12.8	12.8	12.0	13.2
Neck+	2.9	4.8	2.1	1.3	0.0	1.9
Thorax	4.4	9.5	2.1	7.7	4.0	9.4
Abdomen	0.0	0.0	0.0	6.4*	8.0	5.7
Spine	29.4	33.3	27.7	32.1	40.0	28.3
Cervical Strain+	23.5	19.0	25.5	20.5	28.0	17.0
All Other	8.8	23.8	2.1	11.5	12.0	11.3
Upper extremities	20.6	23.8	19.1	16.7	16.0	17.0
Lower extremities	22.1	19.0	23.4	24.4	36.0	18.9
Total No. of Cases	68	21	47	78	25	53

[1] Based on AIS 85 Epidemiologic Modifications (AIS 85-EM)
+ Cervical strain coded to AIS body region Spine
* $p < .05$

TABLE 37

Estimated[+] Relative Risk of Sustaining 1 or More Injuries
to a Specified Body Region After Implementation of
The New York State Seat Belt Use Law for Drivers of Covered Vehicles
Treated in Hospital Emergency Departments Serving Suffolk County, New York,
First Quarter 1984 and 1985

	Relative Risk	
AIS Body Region	Multivariate Model	Univariate Test
Head	0.60*	0.56*
Face: fractures	3.15*	2.14
Face: forehead	0.76	0.62
Face: all other	0.70	0.66
Thorax/Abdomen	1.38	1.27
Neck/Cevical Strain	1.99*	2.11*
Spine	0.90	0.99
Upper Extremities	0.81	0.78
Lower Extremities	1.16	1.00

[+]Estimated using univariate chi-square tests and logistic regression
* $p < .05$

TABLE 38

Estimated[+] Relative Risk of Sustaining 1 or More Injuries
to a Specified Body Region After Implementation of
The New York State Seat Belt Use Law for Drivers of Covered Vehicles
Treated in Hospital Emergency Departments Serving Suffolk County, New York,
First Quarter 1984 and 1985

AIS body region	Relative Risk
Model 1:	
Head but no Spine	0.68
Spine but no Head	1.65
Head and Spine	0.18
Neck/Cervical Strain	2.10
Model 2:	
Head but no Forehead	0.47
Forehead but no Head	0.41
Head and Forehead	0.65
Neck/Cervical Strain	1.95

[+]Estimated using logistic regression with interaction terms

TABLE 39

Percent Cases with Maximum AIS Severity 3^+ and ISS 10^+ by Age and Sex for Drivers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
	Percent Cases with Maximum AIS Severity 3^+					
16-19	7.5	7.7	7.2	1.8*	1.8	1.8
20-49	3.7	5.6	1.9	5.9	6.9	5.1*
50+	7.2	5.9	9.3	0.8*	1.5	0.0*
All Ages	4.9	6.1	3.8	4.5	5.1	3.9
	Percent Cases with ISS 10^+					
16-19	6.8	7.7	5.8	3.6	3.6	3.6
20-49	4.1	6.0	2.3	5.9	6.4	5.5
50+	8.1	7.4	9.3	2.4*	3.1	1.7
All ages	5.2	6.6	3.8	5.0	5.4	4.7

* $p < .05$

TABLE 40

Percent Cases with Maximum AIS Severity 3^+ and ISS 10^+ by Age and Sex for Front Seat Passengers of Vehicles Covered by the Law Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
	Percent Cases with Maximum AIS Severity 3^+					
<20	1.0	0.0	1.6	8.2*	11.1*	6.1
20-49	3.0	5.9	1.5	6.5	2.9	8.6
50+	4.7	0.0	5.7	8.1	0.0	9.1
All Ages	2.5	2.6	2.4	7.4*	6.7	7.9*
	Percent Cases with ISS 10^+					
<20	1.0	0.0	1.6	9.4*	11.1*	8.2
20-49	3.0	5.9	1.5	5.4	2.9	6.9
50+	7.0	0.0	8.6	8.1	0.0	9.1
All ages	2.9	2.6	3.0	7.4*	6.7	7.9

* $p < .05$

TABLE 41

Total Number of Persons Involved In Motor Vehicle Crashes in Suffolk County, New York, as Reported on NYS State Form MV144, 1984 and 1985*

	1984 MV144			1985 MV144		
	Total	Drivers	Occupants	Total	Drivers	Occupants
First Quarter	27,742	11,451	16,291	29,113	11,883	17,230
Second Quarter	32,649	13,033	19,616	34,948	14,068	20,880
Third Quarter	32,600	12,796	19,804	30,189	13,503	20,686
Fourth Quarter	34,436	14,069	20,367	13,761	14,858	21,903
Annual	127,427	51,349	76,078	131,011	54,312	80,699

*MV144 form is the official police crash report form issued by the New York State Department of Motor Vehicle.

FIGURE 1

NEW YORK STATE SEAT BELT USE LAW

COVERED AND UNCOVERED ROAD USE CATEGORIES

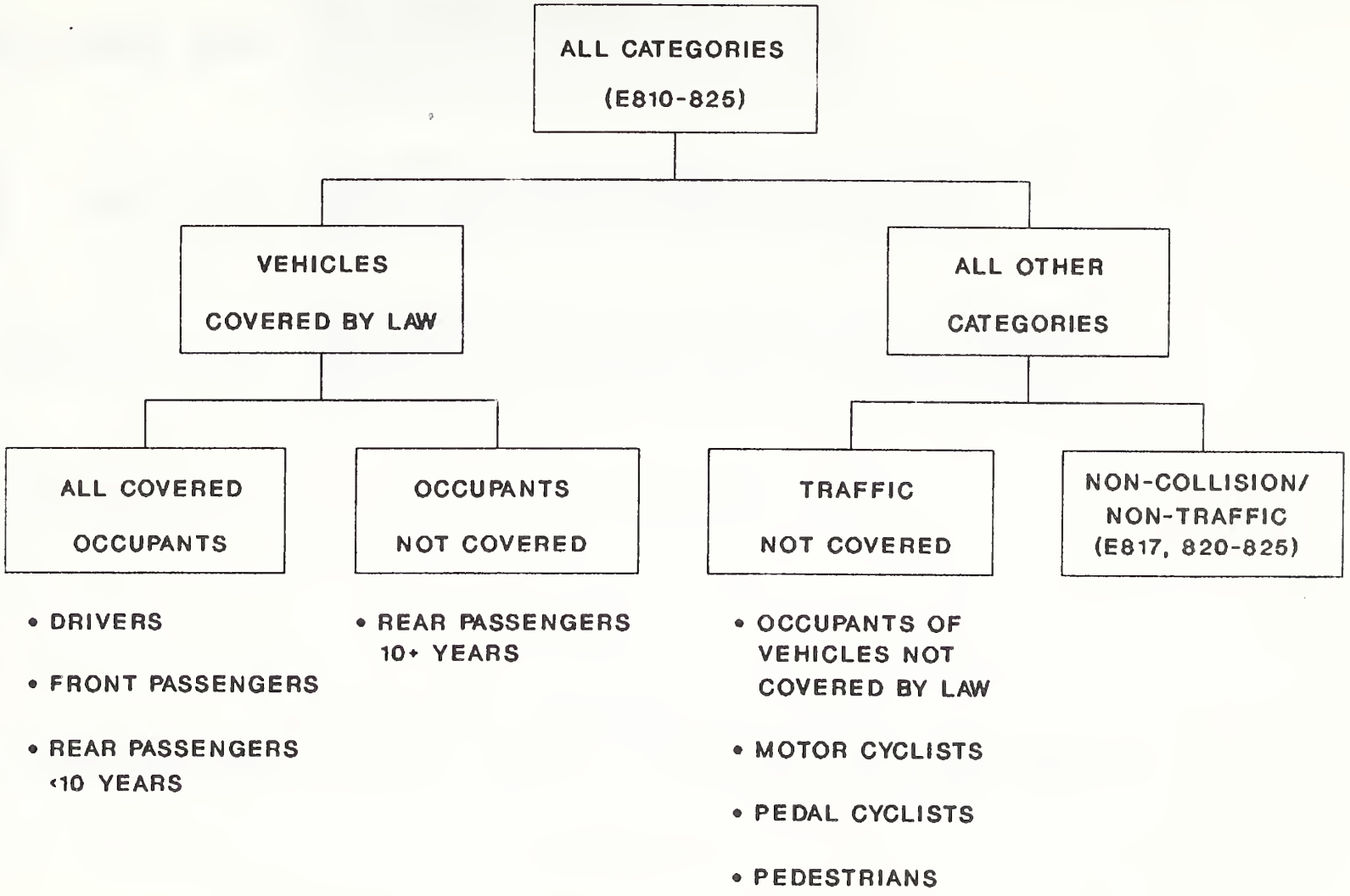
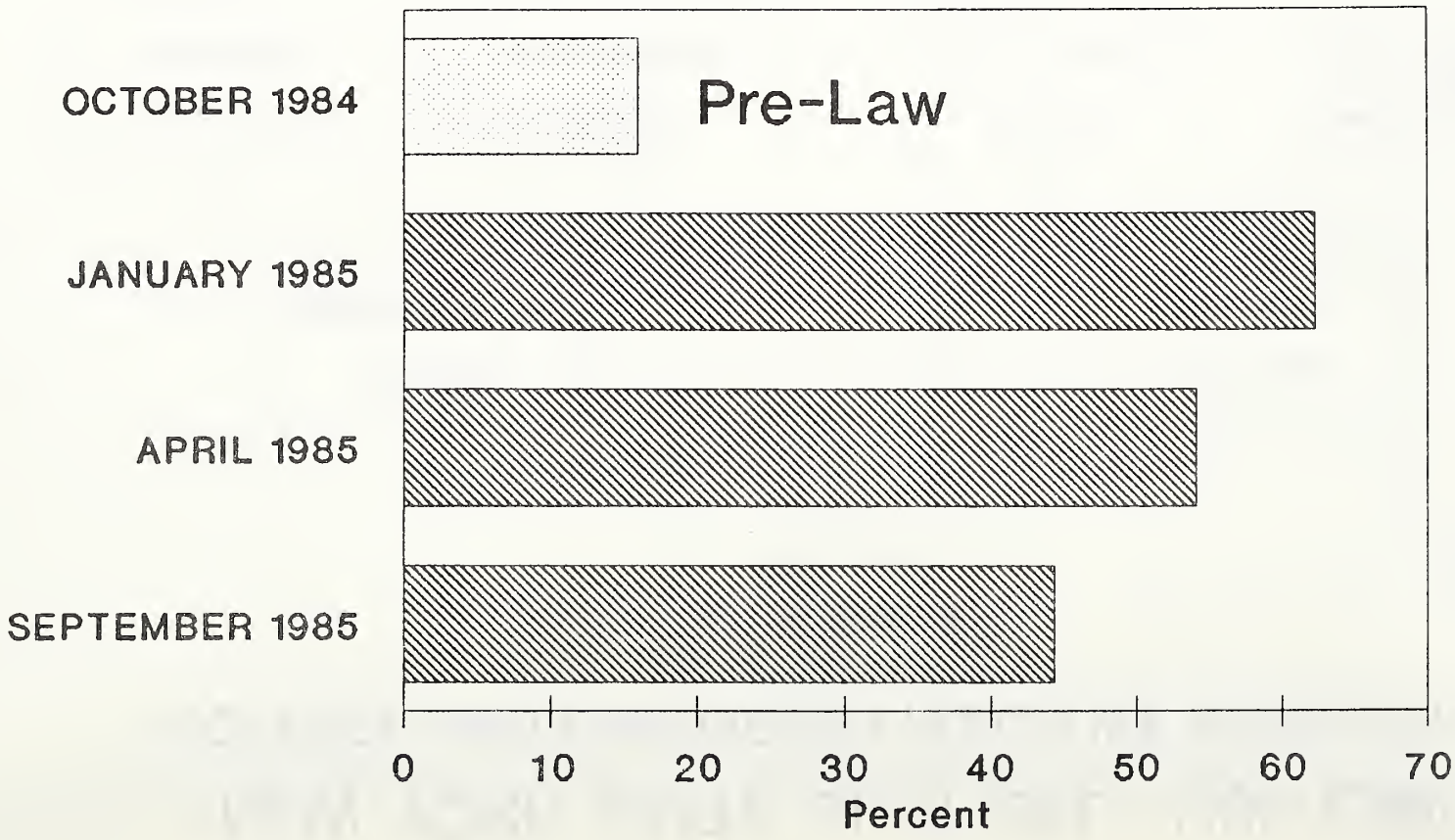


FIGURE 2

OBSERVED SEAT BELT USAGE ESTIMATES SUFFOLK COUNTY, N.Y.



APPENDIX A: DETAILED DESCRIPTION OF OVERALL VEHICULAR TRAUMA FOR SUFFOLK COUNTY, NEW YORK, 1984 AND 1985

Annual injury occurrence rates increased in 1985 for all age groups over 60 (Table A1). There was no consistent pattern of change in occurrence rates for any other age range. Overall vehicular injury rates decreased in the first and third quarters of 1985 and increased in the second and fourth quarters, although only the fourth quarter change was significant (Table A2). The highest occurrence rates for males and females were seen in the 16-24 year age range in both 1984 and 1985 for the entire year and each quarter.

Case-admission ratios increased for all ages between 5 and 49, and decreased for all ages between 50 and 69 (Table A3). There was a significant decrease in the under 5 year age group, and an increase in the 30-34 year age group. For both sexes combined and males, case-admission ratios increased in the first, second and third quarters of 1985, however, only those in the first quarter were statistically significant (Table A4). For females, case-admission ratios increased in the first, third, and fourth quarters, but not significantly.

A decrease in the case admission ratio was observed for persons 65 to 74 years in the first quarter of 1985. A more than five fold increase in the case-admission ratio was observed for females 25-44 in the third quarter of 1985; for persons 16-17 years old a more than four fold increase was seen in the fourth quarter of 1985.

Age-specific fatality rates showed no consistent pattern with age; there was a significant decrease in the 45 to 49 year age group (Table A5).

Consistent decreases in head and face injuries were observed for each quarter of 1985 compared to 1984 (Table A6, A7), although only the 26 percent fourth quarter decrease in face injuries was significant.

Similarly, cervical strain increased in all quarters, significantly in the fourth quarter. All other injuries to the spine generally decreased in the first three quarters and increased in the last quarter of 1985, but not significantly.

Overall, non-residents comprised about 10 percent of the cases in 1984 and 1985. When analyzed by calendar period, non-residents comprised 13 percent of the cases in the third quarter of both years. Incidence patterns were similar to occurrence patterns in each year.

TABLE A1

Estimated Annual Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Age and Sex for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
<5	4.7	2.9	6.6	5.4	6.5	4.2
5-9	7.5	9.3	5.6	6.9	7.9	6.0
10-14	12.1	10.5	13.8	14.5	17.2*	11.5
15-19	51.4	51.0	51.9	45.8	47.4	44.1
20-24	51.1	51.0	51.2	54.7	56.9	52.6
25-29	34.1	39.4	29.1	36.1	41.6	30.9
30-34	19.1	19.1	19.1	20.4	21.3	19.5
35-39	20.9	18.5	23.0	17.7	19.0	16.5
40-44	16.1	16.3	15.9	17.5	15.3	19.6
45-49	17.2	10.9	23.3	14.8	12.0	17.5
50-54	18.7	20.8	16.6	17.6	13.9	21.3
55-59	16.1	15.8	16.4	15.2	16.1	14.3
60-64	10.6	8.0	13.0	11.2	12.9	9.7
65-69	8.3	6.6	9.6	8.8	8.2	9.3
70-74	7.4	10.4	5.4	15.1*	12.7	16.8*
75+	8.9	17.6	4.6	9.0	15.1	5.9
All ages	21.6	21.8	21.4	21.5	22.8	20.3

* $p < .05$

TABLE A2

Estimated Motor Vehicle Trauma Occurrence Rates per 1,000 Population by Calendar Period and by Age and Sex for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			FIRST QUARTER			
<16	1.5	0.8	2.2	2.4	2.1*	2.6
16-17	7.9	11.3	4.4	8.2	10.2	6.1
18-24	12.7	13.0	12.5	10.7	11.3	10.1
25-44	6.0	6.0	6.0	4.6*	4.8	4.4
45-64	3.6	2.5	4.6	2.4	1.7	3.1
65-74	1.2	2.2	0.4	2.5	1.0	3.6*
75+	0.3	0.0	0.5	1.3	0.0	2.0
All ages	4.8	4.7	4.9	4.2	4.2	4.3
			SECOND QUARTER			
<16	2.6	3.1	2.0	2.5	3.1	1.8
16-17	10.8	9.9	11.8	12.3	15.4	9.1
18-24	15.0	13.9	16.1	17.1	17.0	17.2
25-44	5.3	5.8	4.9	6.0	7.1	5.0
45-64	4.1	4.3	3.8	3.1	3.0	3.1
65-74	1.6	1.6	1.6	2.0	3.2	1.2
75+	2.7	6.2	1.0	2.3	2.0	2.5
All ages	5.4	5.7	5.1	5.7	6.5	5.0
			THIRD QUARTER			
<16	3.4	3.2	3.7	2.7	3.3	2.1
16-17	9.7	9.2	10.3	11.5	8.0	15.2
18-24	15.6	16.4	14.8	14.1	14.4	13.9
25-44	5.7	5.9	5.6	4.8	6.0	3.7*
45-64	3.6	2.7	4.4	3.7	3.9	3.5
65-74	3.3	2.7	3.7	2.5	1.6	3.2
75+	2.4	6.2	0.5	2.3	6.1	0.5
All ages	5.8	5.8	5.7	5.2	5.7	4.6*
			FOURTH QUARTER			
<16	1.5	1.5	1.6	2.6*	3.3*	1.9
16-17	20.9	23.3	18.4	12.3*	13.2*	11.4
18-24	13.9	12.0	15.7	13.9	14.9	12.9
25-44	5.5	5.6	5.4	7.3*	6.3	8.3*
45-64	4.8	4.6	4.9	5.7	5.0	6.3
65-74	1.9	1.6	2.0	4.5*	4.2	4.8
75+	3.4	5.2	2.6	3.0	7.1	1.0
All ages	5.6	5.6	5.7	6.5*	6.5	6.5

* $p < .05$

TABLE A3

Estimated Annual Motor Vehicle Trauma Admissions per 100 Injury Cases by Age, and Sex for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
<5	16.0	25.0	11.8	0.0*	0.0*	0.0
5-9	9.8	11.5	6.7	15.8	18.2	12.5
10-14	9.2	14.7	4.8	12.5	14.8	8.8
15-19	11.0	12.4	9.7	13.1	16.1	9.7
20-24	9.3	12.1	6.6	10.4	12.3	8.4
25-29	13.0	17.6	7.1	16.3	19.7	12.0
30-34	3.4	5.3	1.6	9.9*	10.6	9.2
35-39	10.1	10.9	9.5	10.5	15.3	5.5
40-44	8.4	12.2	4.8	9.6	17.5	3.7
45-49	8.6	0.0	12.5	16.1	16.0*	16.2
50-54	8.8	5.3	13.3	6.3	12.0	2.6
55-59	7.4	11.1	3.7	6.0	7.7	4.2
60-64	9.7	18.2	5.0	6.1	0.0	13.3
65-69	15.8	28.6	8.3	4.8	0.0	7.7
70-74	8.3	16.7	0.0	17.9	40.0	5.6
75+	12.5	6.7	22.2	14.8	6.7	25.0
All ages	9.8	12.0	7.7	11.6	14.3	8.8

* $p < .05$

TABLE A4

Estimated Motor Vehicle Trauma Admissions per 100 Injury Cases by Calendar Period, Age, and Sex for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

Age (Years)	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			FIRST QUARTER			
<16	3.6	0.0	5.0	18.6	20.0	17.4
16-17	13.6	12.5	16.7	13.6	21.4	0.0
18-24	10.0	10.7	9.3	15.6	19.1	11.6
25-44	6.4	7.4	5.6	10.8	16.1	5.5
45-64	8.0	11.8	6.1	20.6	25.0	18.2
65-74	50.0	66.7	0.0	0.0*	0.0	0.0
75+	100.0	--	100.0	25.0	--	25.0
All ages	8.7	10.1	7.5	14.3*	18.7*	10.4
			SECOND QUARTER			
<16	25.5	31.0	16.7	24.4	31.0	12.5
16-17	13.3	21.4	6.3	15.2	23.8	0.0
18-24	11.6	11.9	11.4	7.6	4.2	11.0
25-44	10.5	12.3	8.5	15.9	20.5	9.7
45-64	10.5	3.3	18.5	9.3	9.5	9.1
65-74	0.0	0.0	0.0	11.1	16.7	0.0
75+	0.0	0.0	0.0	28.6	0.0	40.0
All ages	12.4	13.6	11.2	13.3	15.7	10.4
			THIRD QUARTER			
<16	7.9	10.0	6.1	12.0	12.9	10.5
16-17	7.4	15.4	0.0	16.1	18.2	15.0
18-24	11.9	11.3	12.5	10.8	13.1	8.5
25-44	9.7	16.7	2.9	14.7	15.7	13.0*
45-64	10.0	10.5	9.7	9.6	11.1	8.0
65-74	16.7	25.0	12.5	18.2	33.3	12.5
75+	20.0	25.0	0.0	0.0	0.0	0.0
All ages	10.3	13.5	7.3	12.4	13.9	10.7
			FOURTH QUARTER			
<16	3.6	7.1	0.0	4.2	6.5	0.0
16-17	3.4	6.1	0.0	15.2*	22.2	6.7
18-24	8.3	13.5	4.4	5.9	7.9	3.6
25-44	11.1	14.5	7.8	9.1	12.3	6.8
45-64	6.1	6.3	5.9	3.8	2.9	4.4
65-74	0.0	0.0	0.0	15.8	25.0	9.1
75+	10.0	0.0	20.0	11.1	14.3	0.0
All ages	7.7	10.4	5.1	7.7	10.3	5.2

* $p < .05$

TABLE A5

Motor Vehicle Trauma Fatalities per 100,000 Population by Age and Sex, Suffolk County, New York, 1984 and 1985

Age (Years)	1984			1985		
	Both Sexes	Male	Female	Both Sexes	Male	Female
<5	2.2	2.1	2.2	2.1	4.2	0.0
5-9	4.2	6.2	2.2	4.2	4.1	4.3
10-14	5.5	9.0	1.9	5.7	9.2	2.0
15-19	23.5	39.5	6.8	25.0	32.3	17.6
20-24	22.6	33.6	11.7	35.8	46.2	25.7
25-29	24.5	38.0	11.9	19.0	37.0	1.9
30-34	13.9	25.2	3.6	12.6	22.4	3.5
35-39	16.6	30.6	3.6	9.0	13.0	5.2
40-44	6.7	6.9	6.6	10.8	15.5	6.3
45-49	15.6	8.6	22.5	2.8*	2.8	2.7*
50-54	14.3	19.0	9.6	8.1	6.4	9.7
55-59	15.2	20.4	10.1	17.2	24.2	10.3
60-64	13.9	21.0	7.5	19.7	16.6	22.4
65-69	14.3	27.1	4.3	7.0	10.5	4.2
70-74	33.8	52.6	20.8	15.1	14.7	15.4
75+	37.5	53.9	29.5	23.0	46.7	11.4
All ages	15.4	22.5	8.6	13.7	19.2	8.4

* $p < .05$

TABLE A6

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			FIRST QUARTER			
External	10.4	11.8	9.1	13.0	9.9	15.9
Head	37.1	44.4	30.5	31.0	34.9	27.4
Face	35.1	38.5	32.1	33.9	39.5	28.7
Facial Fractures	2.8	2.4	3.2	4.4	5.3	3.7
Forehead	18.8	19.5	18.2	16.1	19.7	12.8
Neck+	2.2	2.4	2.1	2.5	3.3	1.8
Thorax	9.3	11.2	7.5	10.4	10.5	10.4
Abdomen	1.4	1.8	1.1	4.4*	5.3	3.7
Spine+	29.5	28.4	30.5	30.7	25.7	35.4
Cervical Strain	21.3	19.5	23.0	21.5	18.4	24.4
All Other	12.1	12.4	11.8	11.4	11.8	11.0
Upper extremities	18.5	18.9	18.2	20.3	20.4	20.1
Lower extremities	28.9	25.4	32.1	33.9	29.6	37.8
Total No. of Cases	356	169	187	316	152	164
			SECOND QUARTER			
External	16.4	17.4	15.3	12.9	13.2	12.4
Head	32.8	32.9	32.7	30.4	29.4	31.6
Face	31.8	29.0	34.7	25.9	29.8	21.2*
Facial Fractures	3.5	2.9	4.1	2.8	2.1	3.6
Forehead	15.4	15.0	15.8	10.5*	13.6	6.7*
Neck+	2.7	2.9	2.6	1.9	3.0	0.5
Thorax	8.4	7.7	9.2	12.1	14.9*	8.8
Abdomen	3.7	3.9	3.6	3.5	3.4	3.6
Spine+	25.1	25.6	24.5	27.1	20.9	34.7*
Cervical Strain	18.4	17.9	18.9	22.9	16.6	30.6*
All Other	9.4	11.1	7.7	7.7	7.2	8.3
Upper extremities	31.0	32.9	29.1	25.9	28.9	22.3
Lower extremities	32.5	30.0	35.2	32.0	36.6	26.4
Total No. of Cases	403	207	196	428	235	193

[1] Based on AIS 85 Epidemiogical Modification (AIS 85-EM)
+ Cervical Strain coded to AIS body region Spine
* $p < .05$

TABLE A7

Estimated Percent Motor Vehicle Trauma Cases with One or More Injuries to an AIS Body Region[1] by Sex and Calendar Period for Persons Treated in Hospital Emergency Departments Serving Suffolk County, New York, 1984 and 1985

AIS Body Region	1984 Both Sexes	1984 Male	1984 Female	1985 Both Sexes	1985 Male	1985 Female
			THIRD QUARTER			
External	18.4	20.0	16.8	16.3	16.3	16.3
Head	28.6	28.6	28.6	23.8	21.5	26.4
Face	30.9	31.0	30.9	29.2	33.0	24.7
Facial Fractures	2.3	2.4	2.3	2.6	1.9	3.4
Forehead	13.7	13.8	13.6	15.8	17.2	14.0
Neck+	3.0	1.0	5.0	3.4	5.3*	1.1*
Thorax	11.4	15.2	7.7	11.4	11.5	11.2
Abdomen	3.7	5.2	2.3	2.6	2.4	2.8
Spine+	28.4	22.4	34.1	30.5	24.9	37.1
Cervical Strain	21.2	12.9	29.1	23.0	15.3	32.0
All Other	10.0	12.4	7.7	9.8	12.0	7.3
Upper extremities	28.8	33.8	24.1	29.7	35.4	23.0
Lower extremities	36.3	39.5	33.2	32.0	33.5	30.3
Total No. of Cases	430	210	220	387	209	178
			FOURTH QUARTER			
External	18.1	18.3	18.0	14.0	14.5	13.7
Head	30.8	32.7	29.0	28.5	27.7	29.3
Face	33.9	38.1	30.0	25.0*	28.5*	21.7*
Facial Fractures	2.6	2.5	2.8	2.5	3.4	1.6
Forehead	15.5	19.3	12.0	11.4	12.3*	10.4
Neck+	1.7	2.0	1.4	2.9	1.7	4.0
Thorax	7.2	6.9	7.4	10.5	11.1	10.0
Abdomen	2.4	2.5	2.3	2.9	3.8	2.0
Spine+	25.1	21.3	28.6	34.3*	32.3*	36.1
Cervical Strain	22.0	18.3	25.3	28.5*	26.4*	30.5
All Other	5.5	5.4	5.5	8.3	6.8	9.6
Upper extremities	23.2	30.2	16.6	20.0	25.5	14.9
Lower extremities	28.9	34.2	24.0	24.4	26.8	22.1
Total No. of Cases	419	202	217	484	235	249

[1] Based on AIS 85 Epidemiogical Modification (AIS 85-EM)
+ Cervical Strain coded to AIS body region Spine
* $p < .05$

APPENDIX B: SCIENTIFIC PUBLICATIONS, REPORTS AND PRESENTATIONS

1. Barancik, J.I., Kramer, C.F., Thode, H.C., Harris, D. "Efficacy of the New York State Seat Belt Law: Preliminary Assessment of Occurrence and Severity", Bulletin of the New York Academy of Medicine, Vol. 64, No.7, Sept.-Oct., 1988, pp. 742-749.

2. Barancik, J.I., Kramer, C.F., Thode, H.C., Jr., Harris, D., "Injury Patterns for Vehicular Occupants Covered by the N.Y.S. Seatbelt Law". Annual Meeting, American Public Health Association, Chicago, Ill., October 25, 1989.

3. Kramer, C.F., Barancik, J.I., "Modification of AIS 85 to Measure Anatomic Site/Severity Patterns," Annual Meeting, American Public Health Association, New Orleans, Louisiana, October 18-22, 1987.

4. Kramer, C.F., Barancik, J.I., AIS Training Manual. BNL 52184, Brookhaven National Laboratory, May 1989.

5. Kramer, C.F., Barancik, J.I., Thode, H.C. Jr., "Measuring Changes in Anatomic Injury Site/Severity Patterns Using Epidemiologic Modifications to AIS 85". First World Conference on Accident and Injury Prevention, Stockholm, Sweden, September 17-20, 1989.

6. Thode, Jr. H.C. and Barancik, J.I. "Using Logistic Regression to Determine Changes in Injury Patterns After Implementation of a Seatbelt Use Law," 1987 Joint Statistical Meetings, San Francisco, CA, August 17-20, 1987.